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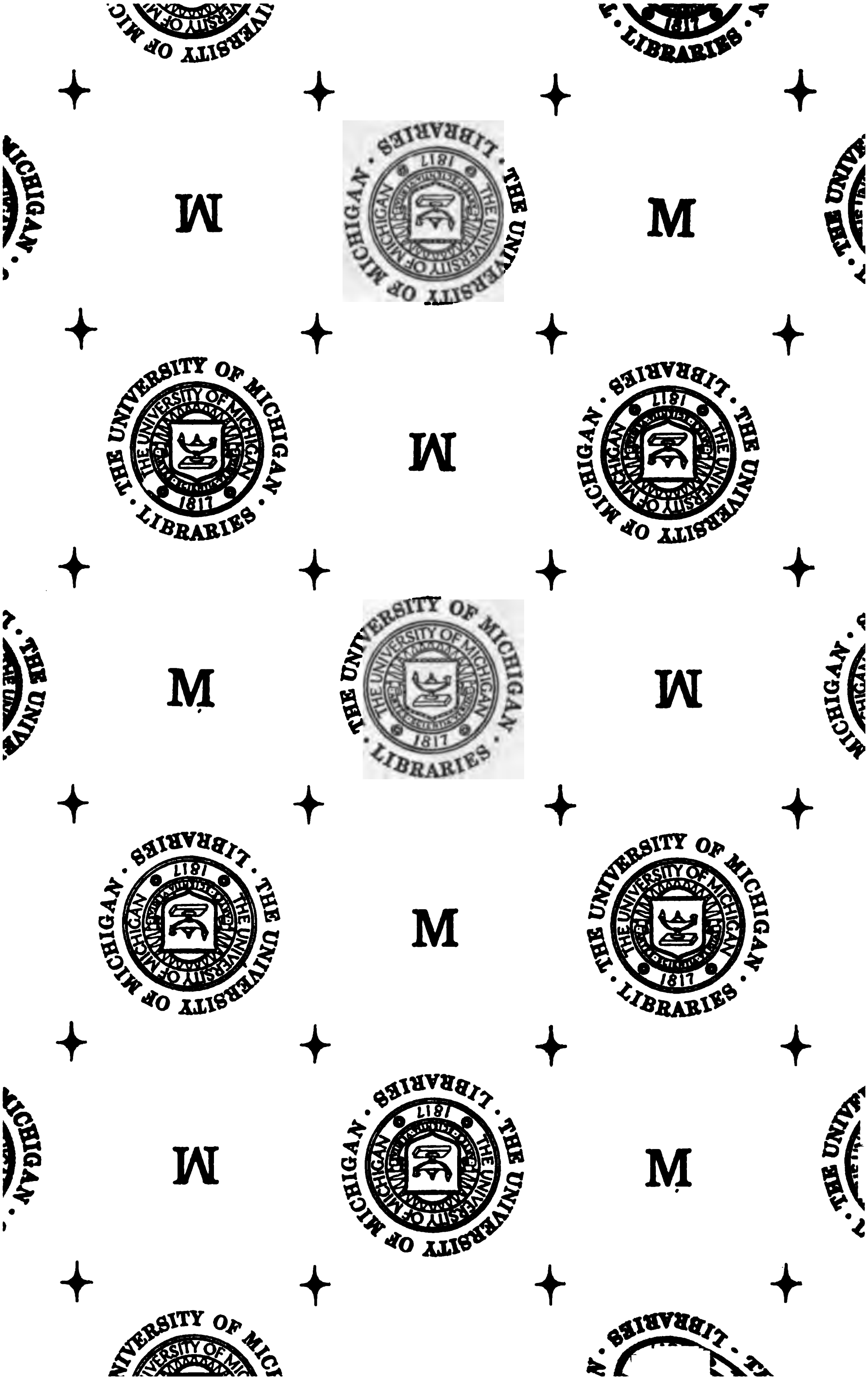

56th Congress, } SENATE. { Document
1st Session. } { No. 306.

ALASKA.

1899.

COPPER RIVER EXPLORING EXPEDITION.

Captain W. R. ABERCROMBIE, Second U. S. Infantry,
COMMANDING.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1900.

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LETTER OF TRANSMITTAL.

WAR DEPARTMENT,
Washington, January 23, 1900.

SIR: Agreeably with Senate resolution dated January 22, 1900, directing the Secretary of War—

> "to transmit to the Senate the report of Capt. W. R. Abercrombie on the Copper River Exploring Expedition to Alaska,"

I have the honor to transmit herewith a report by Capt. W. R. Abercrombie, Second United States Infantry, commanding Copper River Exploring Expedition, of construction work on the trans-Alaskan military road and explorations in the Chettyna Valley during the season of 1899, which embraces the operations of the expedition under the command of Captain Abercrombie during the year 1899.

Very respectfully,

ELIHU ROOT,
Secretary of War.

Hon. WILLIAM P. FRYE,
President pro tempore United States Senate.

COPPER RIVER EXPLORING EXPEDITION.

NOTE.—Numbers in **heavy type** in body of report refer to numbers of the photographs submitted herewith.

WASHINGTON, D. C., *January 10, 1900.*

SIR: I have the honor to submit herewith report of the recent explorations in and the construction of a military route through that portion of Central Alaska known as the "Copper River district," under and by virtue of the following orders and instructions:

GENERAL ORDERS, }
No. 51. }

HDQRS. OF THE ARMY, ADJUTANT-GENERAL'S OFFICE,
Washington, March 20, 1899.

WAR DEPARTMENT,
Washington, March 17, 1899.

A military expedition for exploring purposes in Alaska will be organized as follows, and known as the Copper River Exploring Expedition, and will be announced in orders:

1. Capt. W. R. Abercrombie, Second United States Infantry, commanding; Second Lieut. W. C. Babcock, Eighth United States Cavalry; one acting assistant surgeon, one hospital steward, one commissary sergeant, two noncommissioned officers and eight privates of infantry, of whom two shall be cooks, fully equipped and supplied to November 30, 1899, will proceed to Valdez, on Prince William Sound, Alaska, on or about the 15th proximo, and there establish a camp and depot. From Valdez the expedition will open up a military road to Copper Center, and from the last-named point by the most direct and practicable route to Eagle City.

2. The route above outlined from the coast to Eagle City will be carefully surveyed, triangulated, noting elevations, depressions, and other features, and should be definitely located and properly marked on either side as far as practicable, in order that it may be known and used as a route of travel by the public.

3. The commanding officer will select suitable locations at Valdez, Copper Center, the crossing of the Upper Copper, the crossing of the Tanana, the head of Forty Mile Creek, and at such other points as in his judgment he may deem proper for military reservations, and will survey, lay out by metes and bounds, and declare such reservations, reporting his action hereunder to the Department for the approval of the Secretary of War.

4. This expedition will cover as much territory as possible, and will collect and incorporate in the reports all information that may be valuable to the development of the country explored regarding topographical features, available routes of travel, feasible routes for railroad construction, adaptability for agriculture and stock raising, mineral resources, timber, fuel, food products, and the stock best suited for food and transportation purposes; the number, location, and condition of the natives of the territory explored. Maps and photographs will accompany all reports.

5. The commanding officer of the expedition is authorized to employ the necessary Indians, natives of Alaska, for duty with the expedition as guides for such periods of time as may be necessary.

The Quartermaster's Department will furnish the necessary transportation.

G. D. MEIKLEJOHN,
Acting Secretary of War.

By command of Major-General Miles:

H. C. CORBIN,
Adjutant-General.

WAR DEPARTMENT,
Washington, March 17, 1899.

Capt. W. R. ABERCROMBIE,
Second United States Infantry,
Commanding Copper River Exploring Expedition, Washington, D. C.

SIR: I hand you herewith for your instructions and guidance copy of order issued this date, providing for the organization of the Copper River Exploring Expedition.

In addition to the military personnel of your command as therein indicated you are authorized to employ the following employees upon the terms indicated:

1 surveyor, at $250 per month and rations.
1 assistant surveyor, at $100 per month and rations.
2 guides, at $150 per month and rations.
2 topographers, at $125 per month and rations.
1 clerk, at $100 per month and rations.
1 chief packer, at $75 per month and rations.
8 packers, at $60 per month and rations.
1 pilot, at $75 per month and rations.
1 engineer, at $75 per month and rations.
1 fireman, at $50 per month and rations.
1 foreman, at $75 per month and rations.
15 axmen, at $50 per month and rations.
2 cooks, at $50 per month and rations.
4 rockmen, at $75 per month and rations.

These employees will be paid from appropriations of the Quartermaster's Department.

Referring to Paragraph III of your orders, you are directed to establish a small detachment at each of the military reservations which you may declare, and provide for them such permanent quarters as you may find it practicable to erect under the circumstances.

You will make a careful examination of the fish industry in that country and report everything bearing upon this subject that will be of value.

At Copper Center a full and complete examination will be made of the Copper River, with a view to locating the most practicable crossing. A similar examination will be made for the purpose of locating the best crossing of the upper waters of the Copper River, and also the most desirable passage of the Tanana. In reporting thereon state definitely location of crossings, depth of water, width of stream, and whether conditions will permit fording or the operation of ferries.

The passes over the glaciers and through the mountains finally selected as the most practicable entrance to the interior will also be carefully surveyed, triangulated and platted, with full and complete figures of distance, altitudes, and widths of passes, and should be definitely located and properly marked in order that the same may be declared a military road by the Secretary of War.

Very respectfully,

G. D. MEIKLEJOHN,
Acting Secretary of War.

ORDERS.]

WAR DEPARTMENT,
Washington, March 22, 1899.

Capt. W. R. Abercrombie, Second Infantry, commanding Copper River Exploring Expedition, accompanied by Stephen Birch, guide, will proceed at once to Fort Keogh and Livingston, Mont., there inspect, accept, and brand such pack horses, not to exceed 30 head, as come up to the required standard. On completion of this duty Captain Abercrombie, accompanied by Guide Birch, will proceed to Seattle, Wash. The travel enjoined is necessary for the public service.

G. D. MEIKLEJOHN,
Assistant Secretary of War.

NARRATIVE OF JOURNEY FROM WASHINGTON, D. C., TO SEATTLE, WASH.

Leaving Washington, D. C., on the afternoon of March 22, my first stop-over was at Fort Keogh, Mont., where, upon looking over the available pack horses offered for sale, I found that it would entail a journey to Lame Deer, an old camping ground and substation of Fort Keogh, on an Indian reservation at the head of Tongue River, a distance of some 90 miles, to secure the animal best adapted for my purpose and that would give the best service for the work in hand. However, from information obtained from some friends in Miles City, a small town some 3 miles from the post, I was satisfied that with a little time to visit the ranches in the Upper Yellowstone Valley I could get just what I was directed to accept, which was a thoroughly broken and seasoned pack horse of from 800 to 1,000 pounds in weight, one reared among the foothills of the Rocky Mountains, where the climatic conditions were nearer that of the country in which my expedition was to operate than in any other part of the United States. I also learned that I could probably secure the services of seasoned packers for service with the expedition, as there were a number of men in and around the Yellowstone Park who had been earning their living by taking out parties of tourists during the summer with small pack trains. Past experiences demonstrated to me that it is far better to get these men, if possible, from one locality, so as to avoid any local prejudice that might obtain owing to the frequent quarrels between different cattle outfits during the round-up season, old grudges always coming to the surface when whisky came into camp, which is sure to be the case, no matter how strict the orders against its introduction or how vigilant the watch to keep it out may be. With these facts in view I decided to go to Livingston, where I had a friend, George Wakefield, who for years had operated all the transportation in the Yellowstone Park, a thorough horseman, and probably the best-posted man on the horse question in that part of Montana, and there select the animals for my train.

At the suggestion of a gentleman with some twenty years' experience in shipping stock from the Custer County range to Chicago, at all seasons of the year, I applied to the Quartermaster-General and received authority to ship from Fort Keogh a carload of forage, to be used as a reserve in case the stock was "snowed in" while in transit from Livingston to Seattle. Having seen the forage loaded on the cars and arrangements made for the hauling of the car to Livingston from Fort Keogh, I left that post for Fort Yellowstone to confer with the post quartermaster there, whom I had requested to notify the packers at Gardiner and Cinnabar that I desired to employ men to go north with the expedition for the season. Arriving at Fort Yellowstone, I at once called on Captain Wilder, Fourth Cavalry, the commanding officer, and Lieutenant Kress, of the same regiment, post quartermaster. After explaining and select the animals for the expedition, which request was granted and the "horse board" detailed. I then left Fort Yellowstone for Livingston, where by appointment, I met Mr. Edwin Gillette, of Sheridan, Wyo., whom the Acting Secretary of War had appointed engineer of the expedition. After a conference with Mr. Gillette, who informed me that he knew of some excellent men who had been engaged in the Big Horn Mountains in Wyoming in building trail to the mines and elsewhere for the last eight or ten years, and that he thought I could get no better material than these men for like work in Alaska, I directed him to proceed to Sheridan and employ a foreman of the trail gang, a cook, and the authorized rock workers under the same conditions that I employed the packers, which was transportation to and from Alaska and actual expenses at Seattle. Leaving Livingston the same afternoon I proceeded to Seattle, Wash., where upon arrival I reported to the Department and began the organization of my expedition.

Upon visiting Capt. W. W. Robinson, constructing quartermaster at Seattle, I ascertained that the major portion of the supplies for the expedition were then en route to Seattle. I opened telegraphic communication with Gillette at Sheridan to ascertain what progress he had made in securing skilled men for the trail crew.

From day to day various articles of equipment arrived which had been ordered by the Quartermaster-General from New York, Philadelphia, Chicago, San Francisco, Portland, Oreg., and Seattle. But as the officers who were directed to ship these supplies were also engaged in the more important work of forwarding stores to the army in Cuba and the Philippines, invoices covering these shipments in some cases were not received until after the expedition had arrived at Valdez, which entailed some little confusion in checking the outfit into the steamer. Added to this was the bustle and hurry in Seattle (the principal port of departure for all Alaskan points, as well as the Philippines, from the Northwest) of outfitting transports, etc., which at times threatened to swamp us in confusion.

About this time I received telegraphic orders from the Acting Secretary of War, directing me to equip the expedition with such antiscorbutics as in my judgment would relieve the situation in the Copper River Valley, where the destitute prospectors were reported to be dying daily from scurvy. At the same time I received notification from Lieutenant McKaine, Fourteenth Infantry, acting chief commissary of subsistence at Vancouver Barracks, that he would be in Seattle on the following day to fill my requisition for the relief supplies for the people in the Copper River Valley.

Dr. Neal C. Trew, of San Francisco, having reported for duty as medical officer of the expedition, we, on the arrival of Lieutenant McKaine, Fourteenth Infantry, selected such articles of canned goods as we believed would be required to alleviate the sufferings of the miners at Valdez.

Following the arrival of Dr. Trew came First Lieut. Walter C. Babcock, Eighth Cavalry, topographical officer; Commissary Sergt. J. Augustus Tillman, United States Army, and other members of the expedition, who had all arrived and reported for duty prior to April 10.

The expedition being without the necessary transportation with which to move the antiscorbutics from Port Valdez into the interior, authority was requested for the purchase of two dog teams, which the Quartermaster-General ordered Capt. W. W. Robinson, constructing quartermaster at Seattle, to purchase. Authority was also granted for the employment of two dog drivers. We were particularly fortunate in the purchase of one dog team of five dogs that had just arrived from Dawson, Northwest Territory, where they had been used for two seasons. The other team was composed of selected domestic dogs and turned out to be of little value as a means of transportation. For drivers I found two men who had had experience in Alaska. Like the dog teams, one proved to be first-class and the other not so good.

On the 10th of April, the chief packer, Dave Rhodes, and some of his packers from Livingston, Mont., arrived at Seattle and reported heavy snows on the mountains and rain in the valleys east of the Coast Range.

Captain Robinson, who was trying to locate the carload of pack animals, was informed by the railroad officials that, owing to the washouts and snow blockades on the Northern Pacific Railroad, the scheduled time of all trains had been abandoned, and that they were running "wild" and could not be located. As the steamer on which the expedition was to embark—*The Excelsior* (1)—of the Pacific Steam Whaling Company's line, was about loaded and ready to sail, the situation was

I had known the year before I was led to believe that hundreds were dying of starvation and scurvy beyond the Coast Range in the Copper River Valley. Most of those then in the settlement of Valdez had little or no money, but notwithstanding this fact a wholesale orgy was inaugurated that lasted until midnight, the cabin and decks of the steamer giving unmistakable evidence of the potent influence of the liquor on those who had indulged so freely and who were now lying around in various attitudes sleeping off the effects.

In some way these people became possessed of the idea that the Government contemplated furnishing them transportation from Valdez to Seattle, and it was not for some days that I could disabuse their minds of this fact. That they had passed a terrible winter was beyond all question of doubt; that many of them had died from scurvy and being frozen to death was in evidence at the little graveyard that had sprung up since my departure the year before.

One of the first men from whom I could get an intelligent account of the condition of things was Quartermaster's Agent Charles Brown (7), whose salutation to me was, "My God, Captain, it has been clear hell! I tell you the early days of Montana were not a marker to what I have gone through this winter! It was awful!"

Going ashore with Mr. Brown, I visited the various cabins in which he had housed some 80 or 100 of these destitute prospectors, and from what I saw there I was satisfied that while his remarks might have been forcible they were not an exaggeration.

Many of these people I had met and known the year before were so changed in their appearance, with their long hair hanging down their shoulders and beards covering their entire face, that I do not think I recognized one of them. They were crowded together, from 15 to 20 in log cabins, 12 by 15, and in the center of which was a stove. On the floor of the cabin at night they would spread their blankets and lie down, packed like sardines in a box. Facilities for bathing there were none. Most of them were more or less afflicted with scurvy, while not a few of them had frost-bitten hands, faces, and feet. Their footwear in some cases consisted of the tops of rubber boots that had been cut off by Brown and manufactured into shoes. Around their feet they had wound strips of gunny sacks, which were used in place of socks. Across the cabin from side to side were suspended ropes on which were hung various articles of apparel that had become wet in wallowing through the deep snow and had been hung up at night to dry. The odor emanating from these articles of clothing, the sore feet of those who were frozen, and the saliva and breath of those afflicted with scurvy gave forth a stench that was simply poisonous as well as sickening to a man in good health, and sure death to one in ill-health.

I at once directed Brown to hire a cabin in which to organize a hospital (9 and 11) and another one for a cookhouse (10 and 12) and to employ a crew to run both places.

I noticed in talking to these people that over 70 per cent of them were more or less mentally deranged. My attention was first directed to this fact by their reference to a "glacial demon." One big, rawboned Swede, in particular, described to me how this demon had strangled his son on the glacier, his story being that he had just started from Twelve-Mile Plant (a small collection of huts just across the Coast Range of Mountains from Valdez) with his son to go to the coast in company with some other prospectors. When halfway up the summit of the glacier, his son, who was ahead of him hauling a sled, while he was behind pushing, called to him, saying that the demon had attacked him and had his arms around his neck. The father ran to the son's assistance, but, as he described it, his son being very strong, soon drove the demon away and they passed on their way up toward the summit of Valdez Glacier. The weather was very cold and the wind blowing very hard, so that it made traveling very difficult in passing over the ice between the huge crevasses through which it was necessary to pick their way to gain the summit. While in the thickest of these crevasses, the demon again appeared. He was said to be a small, heavy-built man and very active. He again sprang on the son's shoulders, this time with such a grasp that, although the father did all he could to release him, the demon finally strangled the son to death. The old man then put the son on the sled and brought him down to the Twelve-Mile camp, where the other prospectors helped him bury him.

During the recital of this tale the old man's eyes would blaze and he would go through all the actions to illustrate just how he fought off this imaginary demon. When I heard this story there were some ten or twelve other men in the cabin and at that time it would not have been safe to dispute the theory of the existence of this demon on the

The pack horses and beef cattle were unloaded first, and the method resorted to may be of interest, if not of value, in the future. There being no lighter available, two of the ship's boats were lashed to a fore-and-aft deck beam, forming a craft resembling a catamaran. On the deck beams referred to was placed a decking of loose lumber, leaving room for two men to operate the oars in the bow. A large box, the size of an ordinary horse stall, was swung in the rigging of the ship and lowered into the hold by means of a steam wench. This box was provided with a door at each end that, when opened, had the appearance of a gangway. The animals being led in, both doors were closed and fastened, the box hoisted up over the ship's side and lowered on the deck of the catamaran, which was rowed shore, the front door opened and the animal led out on the beach. The transition from the dark hold of the ship into the glare of the snow so confused and bewildered the animals that on landing them on the beach some of the beef cattle ran back into the bay and were swimming around in the water for over half an hour before they could be driven back to the shore again.

Having landed all the stock, the parts of an escort wagon were sent ashore and put together. The commissary stores, which had been specially put up in 50-pound packages and sacked in canvass, were then unloaded on the beach (**13**) and hauled up (**14**) to a log cabin which had been rented for storage purposes.

The unloading of the supplies of the expedition was kept up uninterruptedly with relays of men and horses until the entire consignment had been landed and housed (**31**).

Upon inspecting the stock it was found that, notwithstanding the long journey by cars and boat of fifteen days, they had arrived without injury to a single animal, which was due in a great measure to the care exercised by Captain Downing in providing stall accommodations on the steamer inclosure.

Having provided shelter for the public property of the expedition, a number of small cabins were rented for quarters, cook houses, etc. (**15, 16, 17, 18, 20, 21**), for the accommodation of the employees. (See report in detail of Post Quartermaster Sergt. Philip Glesener (**8**), acting quartermaster of the expedition.)

RELIEF FEATURE OF THE EXPEDITION.

In compliance with the special instructions of the Acting Secretary of War, extending relief to destitute persons in the mining regions of Alaska under the act of December 18, 1897, I directed Charles Brown, an old Government employee of some forty years standing, who had been appointed by the Acting Secretary of War quartermaster's agent for the relief of destitute persons, to hire, if possible, cabins for hospital (**9**), bunk house (**22**), and mess house (**16**); to equip them, so far as the means at our disposal would admit, so as to care for the sick and destitute in his charge and en route from the interior, and to organize a crew from the most able-bodied to provide fuel and food for the relief station. Under the authority granted me in letter of instructions from the Quartermaster-General, these men were regularly employed at a compensation of $1 per day and a ration.

A detailed report of Quartermaster Agent Brown is submitted herewith, and in submitting such report I have, at the urgent request of many persons who were forced to apply for relief, withheld the list of names, for the reason that I believed it to be an unnecessary humiliation of the many unfortunate men who were forced to accept as a gratuity medical attendance and subsistence from a public institution. The majority of these men appeared to appreciate the spirit of the act under which the Department extended them relief in their distress. But there were many adventurers who, actuated by a sordid desire to save their money and live on the Government by simply misrepresenting their condition, deceived the agent in charge of the station by proclaiming themselves destitute.

It will be noticed in the report of Quartermaster Agent Brown that immediately after landing relief parties were sent out over the Valdez Glacier into the Copper River Valley, equipped with the dog teams (**23**, **24**) and supplies, to bring out to the coast those whose enfeebled condition rendered them helpless. In this connection I desire to call attention to the appended report of Dr. Leroy S. Townsend, who, during the winter of 1898–99, performed the functions of attending physician at the improvised hospital at Copper Center, during what might be termed an epidemic of scurvy in the Copper River Valley. This report was made by Dr. Townsend at my request, as I believed the information contained therein, regarding the loathesome disease of scurvy, would

As the long nights and deep snow crept in on them an uneasiness began to pervade every cabin, and when a sickness appeared, the character of which they were unable to determine and universally diagnosed as black rheumatism, frost bite, and everything but scurvy, they were driven well nigh into a fever of desperation. To flee from these conditions was their one thought and topic of conversation, but where to, was the question on every lip, and when a number, regardless of the consequences, attempted what was considered an impossibility at that season of the year, the passage of the dreaded Valdez Glacier, leaving two-thirds of their party frozen to death on the vast ice fields, far up above the clouds, the panic was complete. If my memory serves me right, I do not think there was a single cabin in the Copper River Valley during the winter of 1898–99 that did not lose at least one of its party from being frozen to death or by scurvy.

As a matter of record and as an object lesson to those contemplating an adventure of this character, I have selected from among scores of written reports turned in to me in the course of my investigation, one by the Wilson Mining Company (appended hereto), who attempted to ascend the Copper River Valley from its mouth early in 1898. The general tenor of this report may be considered as a fair specimen, and without exaggeration of the hardships incident to the prospector's life in the districts of Alaska.

After repeated attempts to supply the sick in the interior with antiscorbutics and fresh food by our limited supply of dog transportation, I directed my clerk, Mr. John F. Rice (whose report I submit herewith), to proceed into the Copper River Valley and establish relief stations at the mouth of Grayling Creek, on the head of the Klutena River, and at Copper Center, some 30 miles below Grayling, on the Copper River. At each of these stations I detailed enlisted men of the expedition to extend relief and encouragement to the demoralized and destitute prospectors. These stations were continued in operation until the latter part of September, when the men were withdrawn therefrom and detailed for duty at Station 3 on the China River, and Station 2 at the mouth of the Keystone Canyon, and Station 1 at the mouth of the Lowe River on Valdez Bay. Just prior to the withdrawal of my men from Copper Center and Grayling, the last of the scurvy patients, a man and a woman, living in a miner's camp near the head of Quartz Creek, a tributary to the Tonsena River, were packed out of that country on horses to Valdez.

The number of persons to whom relief was extended, exclusive of those employed on trail construction and otherwise, were about 480, and represented all nationalities, professions, and classes, both white and black. So far as my observation could determine, the cause of failure was due to their advanced age, which averaged over 47 years, and the lack of knowledge of the general indications of mineral deposits and business qualifications. Ninety-five per cent of them had failed in business ventures many times, and only joined the rush to the gold fields in the hope that they might be one of the lucky men to strike it rich.

It is a well-known fact to the professional miner that his calling involves not only theoretical knowledge of the structure of the earth's crust to detect the impregnations of a mineral-bearing zone, but also a wide experience in the economic development of the same after discovery. Of the 4,000 persons who composed the stampede to the Copper River Valley in 1898, I do not think a man of such caliber was to be found in the ranks.

After the first payment to the destitute miners employed at Valdez on April 31, under the $1 a day rating, Quartermaster Agent Brown informed me that unless I took some steps to prevent these men from squandering their earnings in gambling and drinking that we would be unable to get rid of them. After investigating the matter, I discovered that the local agent of the steamship company plying between Seattle and Valdez was, in direct violation of the law, carrying on a liquor and gambling traffic. This was an embarrassing situation for me, as twenty years experience on the frontier had taught me that the army officer who interfered with the liquor traffic has trouble before him. We had at that time between 80 and 100 destitute men to care for. We had authority to employ 15 of these each month at a rating of $1 per day, which meant, if the steamer came promptly, the deportation of 15 men a month, provided their earnings were spent in the legitimate channel of purchasing their transportation to the States. The course to pursue was obvious. These men must be shipped south, support. This order was extremely unpopular among the whisky element and others interested in like traffic; but the result was satisfactory, as was demonstrated later in the season when one of the cutters of the Treasury Department having called at the Port of Valdez to take south destitute persons, it was found that none remained, and the vessel departed for Seattle without taking on board a single person, and the second cutter, which was to follow the first, was ordered to proceed direct to San Francisco from the Aleutian Islands, without calling at Port Valdez.

CONSTRUCTION OF TRANSALASKAN MILITARY ROAD FROM CANTONMENT AT PORT VALDEZ TO FORT EGBERT, YUKON RIVER, AS DIRECTED IN PARAGRAPH 2 OF GENERAL ORDERS NO. 51, ADJUTANT GENERAL'S ORDERS, CURRENT SERIES.

In selecting the material for the personnel of this duty, those who had been formerly employed in railroad and trail construction through the Big Horn and Rocky Mountains in Colorado and Wyoming were sought, and, as a result, the organization of the expedition at Seattle brought together a number of men of large experience in such work during the earlier days of railroad construction through the mountain divisions of the transcontinental trunk lines.

Under my special instructions I was authorized to employ a surveyor and an assistant surveyor, 2 topographers, a foreman of trail crew, 4 rock workers, 2 cooks and 15 axmen. This authority was afterwards increased by the Acting Secretary of War so as to provide for all the unemployed in the Copper River District.

On the 25th of April I sent my assistant surveyor and foreman on snowshoes **(25)** up to the mouth of the Keystone Canyon to select a construction camp and a site for a substation, as contemplated by paragraph 2 of General Orders, No. 51, Adjutant-General's Office, current series, with instructions to carefully note the depth of snow en route with a view to the use of pack animals. On the 27th of April these men returned and reported that while the snow was quite deep in some places, yet by following up the open stream bed of the Lowe River (which at this season will not average over 10 inches in depth and about 10 yards in width), that an outfit could be packed up to the mouth of the canyon.

The work of construction on this military road is reported in full by First Lieut. Walter C. Babcock, Eighth United States Cavalry, topographical officer of the expedition, who was placed in charge of the construction camp at the inception of the work, and later on sent forward with the locating party. On the 29th of April the trail crew **(26)** left the cantonment at Valdez and proceeded to the mouth of the Keystone Canyon **(27)**. The reason for commencing work at the mouth of the Keystone Canyon, instead of starting from Valdez, was that the first 15 miles of the trail passed over the flood plain of the Lowe River Valley (**28, 45**), which at this season of the year was covered by some 3 or 4 feet of drifted snow, making it impossible to tell just where the glacial streams would cut during the high-water period of July and August; whereas by beginning work at the mouth of the canyon the construction party could work up into and over the foothills of the canyon, and down the Lowe River Valley over ground that was known to be above the high-water mark. This initial point is designated on the accompanying map as station (**29, 30**) No. 2, and is 14 miles from tide water and 270 feet above sea level.

While the trail crew were engaged in building log cabins for station 2, the surveyors were pushing forward the preliminary line of location along the left or west side of the canyon, which was found to be about 3½ miles in length. This work was very slow and laborious, owing to the deep, soft snow which was now melting quite rapidly. By reference to the accompanying map it will be found that the formation of this canyon is eruptive in character, being much broken, as shown by the irregularities of the contours. Starting in on a hillside cut a half mile below station 2, the trail follows the side of the foothills in a northeasterly direction, through a heavy growth of spruce timber and underbrush, until it crosses a small stream at an elevation of some 600 feet, where it bears off sharp to the north and climbs the face of a bench or fork in the formation with more or less retaining wall, where it again takes an easterly trend, describing a half circle back to the north again, crossing a creek and bridge No. 1; again bearing off to the east along the canyon wall where the road is cut through almost solid rock, keeping at an elevation of about 700 feet and following the meanderings of the canyon to its head.

The scenery of this portion of the trail is unique in character (**32,** a slope which, like that in the canyon, is covered with a dense growth of alder, wild flowers, and grass, which from year to year has formed a vegetable mold, covering the gravel and bed rock from 2 to 2½ feet thick, which holds the water like a sponge and is soon cut up into a fine brown muck. As it rains constantly in this section of the mountains there is a continuous seeping down the trail, making ballasting a necessity to keep the roadbed in passable condition, while in crossing the small streams, which are numerous, a short piece of retaining wall is necessary to hold the trail in place.

Leaving this hillside cut, the trail crosses the first stream of any size (**46**), which is a drainage of the east end of the Corbin Glacier (**55**). The site selected for the construction of bridge No. 2 was on a reverse curve of the stream, where one abutment could be placed on a solid rock foundation, while the other rested on a crib built in an eddy (**46**). Crossing over this bridge, the trail passes along through what is known as Dutch Flat (**48, 49, 50, 51**), over an old moraine, through a heavy growth of cottonwood timber and a second glacial stream, which is spanned by a two-abutment bridge (**52**), one crib of which is built around a large bowlder and the other in an eddy. From this point the trail begins to climb up out of the Lowe River Valley by a sidehill cut, through gravel and a green schist rock very hard in character; over a succession of benches or immense rock ledges by an imperceptible grade to the summit of Thompson Pass (**48**) (which is simply a sag in the backbone of the main range), and then drops down into Ptarmigan Creek, which flows into the Chena River some 6 miles below over a still easier grading than that encountered in climbing up the south side of the range. The topography here is very rocky and broken. Following down Ptarmigan Creek for some 3 miles, the trail comes out into quite a wide valley space (**53, 54**), which is composed of washed gravels formed into numerous sandbars. Following down the eastern side of the Chena Valley, sometimes called the South Fork of the Tiekell, the first 6 miles of the trail are over old morainic matter, covered with a rank growth of grass and red willows, after passing which the mountain sides become more abrupt and the valley space narrows in. The trail from here on to the first crossing of the Chena at the second canyon is like in character that from the head of Keystone Pass to the crossing of the Corbin Glacier stream, a sidehill cut with an occasional retaining wall.

Ten miles down the Chena Valley from Thompson Pass is the first spruce timber met with on the Copper River side of the range. Here station 3 (**56**) is located, which consists of a log storehouse with a shingle roof, for the preservation of supplies, and a smaller cabin, with a shingle roof, for the station keepers. The river on entering the first canyon, which is a few miles below station 3, makes an abrupt turn to the west, which course it holds for half a mile or more, when it again turns to the north, rushing down the valley through a succession of small rocky canyons, across one of which, 3 miles below station 3, the trail crosses at a narrow gorge by a bridge 120 feet long and about 30 feet above low-water mark (**57, 58, 59, 60, 61, 62**). This bridge consists of one crib built on a portion of bed rock, submerged at high water, its corresponding abutments being rocky reefs on the opposite shore. To hold a crib under a bridge in this country it is absolutely necessary to secure a rocky foundation, for, in addition to the great velocity with which these mountain torrents flow, there is carried an immense amount of detritus, carried downstream from the eroding glacier walls many thousand feet above on the mountain summits, which increases the specific gravity of the water about 50 per cent; and if the crib is not built on an absolutely solid foundation a vibratory motion is soon set up which carries away the structure and a washout will be the result. Following down the west bank of the Chena, after crossing this bridge, for a distance of some 7 miles over a large broken country, the last canyon is passed and the river bottom again opens out into a gravel bar formation, which continues to the junction of the Chena and Kanata rivers called the North Fork, which form the Tickell, which river flows into the Copper through a series of canyons some 15 miles in length, about 50 miles below Woods Canyon.

About 10 miles below station 3, in a cottonwood grove, will be found a log relief cabin (**63**), placed in this particular location as a harbor of safety to the traveler, for the reason that in this canyon section, between this cabin and station 3, the storms in winter, which last from three to five days, appear to concentrate their fury. Some 10 miles below this cabin the trail crosses a small peninsula, locally known as the Stewart Creek Divide (**64**), and, keeping close to the base of the mountain, crosses Stewart Creek (**65**), which is bridged at a gorge 1 mile above its mouth.

work in the interior during that period when the snow on the coast is too deep to move stock in.

For the use of those prospecting the Chettyna and Kotsena districts the trail should be located down the Tonsena Valley to a crossing of the Copper; while for those traveling into the Chestochena and Forty-Mile districts it should continue northeast, crossing the Klutena and Tazlena and striking the head of the Chestochena. The base of the main range should be followed to a large lake which has an outlet into the Slahna Valley, crossing which the Tok may be followed to the Tanana. For the Upper Tanana and White River districts a crossing should be made at Copper Center, thence in an easterly direction across the big bend of the Copper over the Mount Sanford Plateau to the south of Cornwall Ridge, again crossing the Copper near its head waters to the Tanana and White River country. (See general sketch of the Upper Tanana and its watershed.)

As that portion of the Trans-Alaskan Military Road already constructed is the only means of entering central Alaska from the Pacific Ocean, it is of the utmost importance to the traveling public that what I might term the mountain division, from station 2 to the Tonsena watershed, should be kept in repair, for, while in its green condition and before the roadbed thoroughly settles and becomes packed by traffic, one season's neglect would, in my opinion, put it in an impassable condition and render the results of last season's labor, as well as the expense of construction incurred, a profitless undertaking and a total loss to the public. Washouts and landslides along the sidehill cuts of the mountains and the unequal settling of the cribs in bridge construction render it imperative, for the first year at least following construction, that this trail should be kept in repair to be of any permanent value.

To eliminate as far as possible the loss of life from freezing, incident to traveling over the divide in winter from station 2 to station 3, I began the construction of a telephone line, which was carried up to within 3 miles of the summit, when, owing to the lack of transportation, I was forced to abandon its completion. To connect with this line, I started a second from my cantonment at Port Valdez, which I carried to within a mile and a half of station 2. It was my intention to paint the poles on the summit with alternate rings of black and white, similar to the guideposts used on the Russian postal roads through Siberia, but my transportation failing I was unable to connect these lines.

During the latter part of June and the fore part of July the enormous flow of water (**68, 69, 70, 71, 72**) from the Valdez Glacier (**6, 73, 74**) bade fair to wash away not only the town of Valdez (**75, 76, 77, 78, 79, 80**) but our cantonment. The volume was so great as to entirely cut off all communication with the interior, except from a narrow strip of land at the mouth of Lowe River, at which point I constructed a log storehouse and cabin, designated as station 1, and practically the southern terminal of the military road. From observations made during high water, I found that during the latter part of July and the first part of August that the gravel bars in Lowe River were covered to such a depth (45) that it was necessary to build the trail along a sidehill. Having completed this work I, on the 27th of July, relieved Lieutenant Babcock in charge of the construction camp and sent him forward with a locating party to carry the line if possible to the crossing of the Klutena River, but owing to the dense growth of underbrush, which had to be cut before horses could be taken through, it was found that the cutting of the preliminary line involved about as much labor as the clearing of a right of way for a railroad in an ordinary country. The farthest point north, therefore, reached by this party was the Tonsena Valley.

THE ESTABLISHMENT OF THE ALL-AMERICAN POSTAL SERVICE FROM PORT VALDEZ, ON THE PACIFIC COAST, TO EAGLE CITY, ON THE YUKON RIVER.

On the 3d of April Mr. C. L. Wayland, inspector of postal department, reported to me under instructions from the Postmaster-General, to accompany the expedition with a view to establishing a postal route from Valdez via Copper Center, Slahna River, Mentasta Pass, Tanana River, Forty-Mile River, to Eagle City. After a conference it was decided that I should take Mr. Wayland's outfit up with me on the steamer *Excelsior*, direct to Valdez, while he stopped at Juneau and Skagway, joining the expedition later at Port Valdez, which he did.

In the summer of 1898 a postmaster was appointed at Port Valdez by Inspector Clumb, of the postal department, but, unfortunately, the authorities to receive it, that I would take the pouch from him by force and deliver it to the postmaster. He delivered the pouch to the postmaster. Upon the arrival of Mr. Wayland, I called his attention to the existing conditions and informed him of my action, of which he approved. He then readjusted matters, appointing a new postmaster, which greatly improved the mail service.

After the military trail had been opened up from the Keystone Canyon, I started a detachment (**81, 82**), in charge of Mr. John F. Rice (whose report is submitted herewith), to escort Mr. Wayland through the Copper River and Tanana valleys to Eagle City, on the Yukon.

EXPLORATIONS IN THE COPPER RIVER DRAINAGE DURING THE SEASON OF 1899.

On the 15th of June the topographers having triangled and taken the soundings of Port Valdez and carried the topographical work up to the mouth of the Keystone Canyon to connect with that of First Lieut. Walter C. Babcock, Eighth Cavalry, topographical officer, I directed Topographer Oscar Rohn (whose report is submitted herewith) to proceed, with an outfit of pack horses and dogs (**83, 84, 147**), into the interior via Thompson Pass, thence down the Tonsena River to a crossing on the Copper, and from that point to explore the country in the Chettyna River drainage and, if possible, cross over from this valley to the head waters of the Copper River, thence down the Copper River to the mouth of the Klutena, in time to return to the coast not later than October 25. In addition to sketching in the topography of the country traveled over, Mr. Rohn was directed to gather all useful information bearing on the geological, agricultural, and forestry resources and to determine, if possible, the alleged existence of geysers among the foothills of Mount Wrangell.

On the 27th of July I sent Mr. A. M. Powell, one of my guides who had accompanied me during the exploration of the previous season, to proceed over into the Klutena country, and, starting from a point of departure on the Klutena River locally known as the Devils Elbow, to go in a general course of east by north to the foothills of the main Alaskan Range, thence in an easterly direction along these foothills to the head waters of the Slahna River in the vicinity of Mentasta Pass, to note the location of available hay meadows and sites for substations, and the depth of streams with a view to the selection of sites for the construction of bridges.

I submit herewith a detailed report of Mr. Powell's explorations.

FEASIBILITY OF RAILROAD CONSTRUCTION FROM PORT VALDEZ THROUGH CENTRAL ALASKA INTO THE YUKON COUNTRY.

The harbor of Port Valdez (**85**) is what is technically known as a submerged valley, the head of which is filled in with glacial deposits and *terminal moraine*. The harbor from Stanton Narrows to the mouth of Lowe River (**86**) is some 10 miles long by 3 miles wide. The environment is a series of lofty, saw-tooth mountains (**87, 88**), plunging abruptly into the bay. Owing to the great depth of water and the proximity of the warm Japan current, this harbor, with the exception of a mile and a half at its head, where the fresh water flowing on the surface of the salt forms a scum of ice from 1 to 6 inches thick at spasmodic intervals during the month of January, is accessible at all seasons of the year for ships of any size. The most desirable anchorage, owing to the great depth of water, which ranges from 80 to 112 fathoms, is a flat about 1 mile square below the mouth of Lowe River, where a 30-fathom anchorage can be found at low water up to 1,000 yards from shore, where the water drops off to the depth of 70 or 80 fathoms.

Owing to the immense flow of water from the Valdez Glacier, which is so erratic in its course as to wash the entire plain between the foot of this glacier and tide water (**85**), the only feasible point of departure which would embrace all the natural facilities for railroad terminals would be a narrow neck of land from one-half to three-quarters of a mile broad and extending up the Lowe River Valley some 5 miles and south of a small stream which is an outlet of Robe Lake. Following up the Lowe River Valley, the line would naturally keep to the north side over a practically nominal grade, passing through the Keystone Canyon with ordinary canyon work, and emerging on the flood plain of the inter-canyon basin. The operator would from this point have the choice of two routes, one route following an easterly direction over Marshall Pass at an elevation of 1,700 feet, and down the Tasnuna to the Copper River Valley; the other, turning to the north, crossing the mountain range at Thompson Pass with an altitude of 2,600 feet, thence down the Tickell River Valley through the swampy pass at the head of the Kanata, thence down the Tonsena into the Copper River

New England States, resulted in a practical demonstration of the existence of heavily mineralized zones of copper, borite, and other ores in the mountainous districts of the Chettyna, Mount Blackburn, Tanana, and White River, which collectively may be classified as the Wrangell Series, and in the main range of the Rocky Mountains at the head of the Chestochena River. From this area I succeeded in obtaining thirty-five hand samples of average ore, which upon assay showed the presence of a percentage of from 16 to 81 per cent in copper, with traces of gold and silver. There can be very little doubt that in favorable localities of the Wrangell group of mountains (which are volcanic in origin) concentrated copper deposits will be found in great masses. It is not uncommon to find nuggets of native copper in the shape of float, varying in size from small bird shot to pieces weighing many pounds. While this metal seems to predominate in an oxidized form, cinnabar, galena, gold, silver, and iron ores have been found in many places; while placer deposits carrying gold as coarse as corn kernels have been discovered on Quartz Creek, Fall Creek, and on the head waters of the Chestochena. On the latter stream the pay gravel is said to run from $1 to $25 per cubic yard. Coal deposits of the Kenai series were found on the Tazlena, Gakona, and Chestochena, which are said to be of a very high order of lignite and of economic value. Marble of various colors is found in quite extended dikes.

Attention is invited to the subreports of Mr. Oscar Rohn, H. M. Powell, and H. B. Pearson, covering the districts above referred to.

In addition to the information relative to the agricultural possibilities of this section of the country, reported on by me last season, I desire to call particular attention to the fact that potatoes, beets, turnips, radishes, pease, and lettuce for the sustenance of man may be grown in almost unlimited quantities, while oats, rye, and wheat were matured during the past season (89).

With a view to giving employment to the stranded prospectors, I was authorized to accept proposals for hay contracts at Port Valdez and in the Copper River Valley, which resulted in the putting up of some 70 to 80 tons of hay, of as fine a quality as that usually delivered under like contracts at military posts in Montana and Wyoming.

I wish to emphatically call attention to the fact that, owing to the absence of that season known as the fall of the year, the transition from summer to winter being so rapid—usually a matter of a few days—the grass is blighted by the frost while green and becomes valueless as an article of forage.

Should the mineral resources of this country develop to such an extent as to support a large mining population that would consume a local product the future for the small farmer in this section of Alaska will undoubtedly be attractive to many.

The most promising and lucrative future will be the driving of cattle from Port Valdez into the Yukon mining districts. Thousands of head of horses and cattle can be subsisted upon the grasses of this section by crossing in the summer, and on the grain and hay that can be grown by the small farmer and sold at a handsome profit during the winter.

The high freight rates of marine transportation from Seattle to the Yukon River points, and those of dog and man transportation from the latter points to the head waters of the various creeks on which are located the mining camps of the Forty-Mile district, brings the cost of transportation of food into that country up to the estimated figure of 45 cents per pound and renders the $10 a day diggings valueless under the existing conditions. As the cost of steamer transportation between Seattle and Haines Mission (the southern terminal of the Dalton trail, over which cattle are now driven to Rink Rapids on the Yukon, where they are slaughtered and the carcasses shipped down the river to Dawson, Eagle, and other points), and that to Valdez (the terminal of the Trans-Alaskan Military Road) would be about the same, the saving in mileage from Valdez to the Forty-Mile country would be some 200 miles. From Valdez cattle can be delivered on the hoof to any of the camps now in operation in the Forty-Mile district, thus saving the cost of their transportation from the coast. To make this drive the stock should be landed at Valdez not later than June 1 and graze through the Forty-Mile country, where they should arrive not latter than August 20. From this point small bands could be driven to the various camps and slaughtered late in September, when the climatic condition would keep the carcasses in a perfect state of preservation for consumption as desired. If, on the other hand, it was desirable to winter the animals at these points for delivery in the early spring, marvel of endurance. On the 29th day of April they packed their first load out of Valdez in snow from 3 to 5 feet deep, in which they were perfectly at home. As the snow melted and the water in the river rose, they behaved equally well in fording the swiftest streams. Later on, when the rainy season set in, they kept in good flesh and did excellent work. Early in the season I saw from the consumption of food at the construction camp that it would be impossible to stock the substations along the trail and keep the construction camp supplied with the horse train alone. I therefore asked for a pack train of 20 mules, to be used over that part of the trail that had been completed from Valdez to the head of the Chena River or station 3. From this point it was my intention to supply the construction camp by means of the horse train. On the 20th day of August I was notified that the mule train had been shipped from San Francisco and was due to leave Seattle on the 1st of September and arrive at Valdez not later than the 10th; but, owing to the failure of the quartermaster at Seattle to promptly transship these animals, they did not arrive in Valdez until the 1st of October, when it was found that their condition was such as to render them unserviceable during the latter part of the season. The stalls prepared for these animals on board the steamer *Cleveland* were of such a flimsy, shoddy construction that the partitions were crushed in while in transit and five or six of the animals trampled to death, while all were more or less seriously bruised.

The packers sent north with this train, being natives of California and Arizona, were wholly unfit for the work in hand, and abandoned a cargo of supplies near the summit of Thompson Pass, and returned to Port Valdez to be discharged. These supplies were afterwards packed over the pass by my Montana crew (92). The loss of the services of the mule train was particularly vexatious, and in my opinion was entirely uncalled for. Had the stall accommodations been properly constructed there could have been no breaking of the side rails of the stalls and consequently no mangling of the stock.

The loss of the services of this transportation curtailed the season some fifteen or twenty days, which meant a corresponding reduction in the mileage of the trail of some 25 or 30 miles; for, notwithstanding the fact that we packed the horses until they dropped on the trail from exhaustion, due to the insufficiency of food after the grass had been cut down by the frost, we were unable to get supplies into the construction camp to keep the trail gang at work.

The most serviceable equipment operating in this country was found to be a pack saddle combining desirable features of the McClellan riding saddle and the Indian sawbuck (91). The Indian sawbuck, owing to the lowness of its crosstrees, has always been a horse killer, owing to the fact that it would invariably jam up the animal's withers in traveling down a long hill. To retain this crosstree, which was indispensable to the unskilled packer in rigging his squaw hitch with which to hold his load in place on the saddle, I took a very heavy McClellan tree, pared out the space under the pommel and cantle (so as to remove the pressure from the withers of any ordinary horse), and carved out a knob or hitching post on the top with which to rig the sling rope, gave the cantle about a 45-degree sheer, rigged the sides of the tree with iron loops for stirrup straps, so that, when not loaded, it could be used as a riding saddle. In place of the ordinary canvas cinch, which it was found soon rotted, I used the hair cinch of a riding saddle. For breeching and breast strap a padded canvas band was used, which, when wet, molded itself nearly to the shape of the horse and prevented chafing. For the use of small detachments with unskilled packers I used large canvas panniers, reenforced with leather, provided with two leather sling straps that hook over the front and back knob of the saddle. These panniers were fastened under the horse's belly by means of a light cinch, which obviated the use of a lash rope. Such a rigging, in my opinion, would be extremely valuable for small commands operating in the mountain divisions in Cuba and the Philippine Islands. Owing to the heavy growth of underbrush the picket line can not be used, but side lines, with animals that are hard to catch, were found to be very effective. Horse covers and cheap saddle blankets are valueless in the coast section, owing to constant rain, which renders it impossible to dry the rigging out. The shoe used was the "Never-slip brand," which is an ordinary plate with two holes on each side, into which may be screwed four pointed cones, which were intended to take the place of heel and toe caulks when traveling over icy surfaces. The valuable points of this shoe are that when traveling through deep

MILITARY RESERVATIONS.

To equip this route with the necessary forage for pack animals traveling between Port Valdez and Fort Egbert it will be necessary to reserve a number of hay meadows so situated as to distribute the forage at points from 30 to 40 miles apart along the trail. The first of this series of hay meadows was located last August near the head of the Kanata River, where some 40 tons of hay were cut and stacked.

The reservation selected by me in 1898 for the cantonment of the Alaskan Exploring Expedition No. 2, and which was used in 1899 by the Copper River Exploring Expedition, was found to be utterly valueless for any purpose whatsoever, owing to its liability to overflow from streams formed by the melting of the ice of the Valdez glacier during the months of June, July, and August. I, therefore, in company with Lieutenant Babcock, topographical officer, and Edwin Gillette, engineer of the expedition, carefully inspected all available sites for a military reservation along the shores of Port Valdez, and, as a result of that inspection, a site (150) was selected, designated on the accompanying map as "Ludington's Landing." The points of intrinsic value that recommend its selection are its water supply, which consists of a mountain stream that flows all the year round, carrying with it sufficient fall for all sanitary purposes; the proximity of deep water and good anchorage, where ships laden with building material can find excellent facilities for discharging their cargoes. The wood supply in the neighborhood of Port Valdez appears almost inexhaustible. With the aid of the steam launch attached to the expedition (135) rafts may be prepared and towed to Ludington's Landing.

The topography of the mountains in the rear of this site is such as to offer a most excellent rifle range. It is just far enough from the head of Port Valdez to be beyond the influences of the whisky element to be found in frontier towns.

In the early part of June I inspected a large meadow at the mouth of Mineral Creek, almost opposite Ludington's Landing, with a view of locating it as a hay meadow, but owing to the subsequent development of a local climatic condition that indicated more or less rain daily during the months of July, August and September, I abandoned the idea of locating a hay ranch for the main station in Port Valdez, but am led to believe, from inquiry among the squaw men of Prince Williams Sound, that a hay reservation of ample proportions can be located at the head of Port Fidalgo, where there are no glaciers, and therefore free from local rains incident thereto.

CANTONMENT AT VALDEZ—EQUIPMENT AVAILABLE FOR CONSTRUCTION OF TRAIL—RECOMMENDATION FOR THE SEASON OF 1900.

The cantonment at Valdez consists of four log buildings, chinked with moss and roofed with shingles. One of the buildings is an office, the loft of which is occupied as a sleeping apartment by the noncommissioned officer in charge of the detachment; another is used as a bunk house (**22**), at present occupied by 3 enlisted men and 18 quartermaster employees; another as a mess house (**16**) for the accommodation of enlisted men and quartermaster employees; the remaining building is a log stable (**95, 96**) capable of sheltering 40 animals. In addition to this stable is a large stable built of boards, with a roofing of tar paper, built to accommodate the transportation of the Cook Inlet Expedition.

The transportation equipment consists of 19 pack mules, with rigging complete; 63 pack horses, with rigging more or less incomplete, due to wear and tear of last season's work.

At the close of the season, October 31, 1899, all quartermaster employees, except those absolutely necessary to care for the public property pertaining to the expedition were discharged. The packers brought up from the States were given transportation to their homes as per terms of agreement when employed, while the four elected to remain were continued in the service.

To carry out the recommendations of Maj. P. H. Ray, Eighth U. S. Infantry, commanding the District of North Alaska, looking to the completion of the trans-Alaskan military road from Port Valdez to some common point on the Tanana River, to where he would complete a wagon road from Forty-Mile, thus giving a continuous route from tide water on the Pacific to the headquarters of the district, Fort Egbert, Alaska, I had built in a favorable locality, at the head

As it will be necessary to provide crossings at the Klutena and Tazlena rivers, and as it is imperative that this work should be done at low water, when a solid foundation can be made on which the cribs or abutments of the bridge may rest, I had in view the utilizing of the pack horses wintered in the interior for packing supplies from Station 3 to the crossings above referred to at the Klutena and Tazlena rivers, to subsist small working parties in putting in these cribs or abutments in advance of the main party.

To carry on this work during the season of 1900, I recommend that two of the employees of last season be retained, viz, Mr. C. E. Worthington as transitman, and Lars Holland, foreman of the construction gang. The latter is eminently fitted for his duties, being skilled in trail grading and heavy timber work, and, above all, having fine control of his workmen. The chief of the party locating the line in advance of the construction party must be one with a professional standing at stake, who is personally responsible for the line of location and over whom there is an official control greater than that of employer over employee, i. e., a commissioned officer. For this work I most urgently recommend, as indispensable to the best interests of the service, that First Lieut. Walter C. Babcock, Eighth United States Cavalry, be continued on this detail, where he has proven his ability to select the best ground, through intricate and perplexing stretches of country, where faulty location means an unnecessary expenditure of public funds, a loss of time, and a reflection upon the officer in command of the expedition. As an example: At the beginning of road building in 1899, the faulty location for the line by a Mr. Palmer and his lack of energy resulted in a delay of some ten days and a week's wasted labor by the construction gang while relocating his faulty work. The locating and construction parties for the continuance of this work should leave the cantonment at Valdez not later than March 10 next, and should consist of a lieutenant in charge of the locating party with 2 scouts, 1 transit man, 2 axmen, and 1 cook; for the construction party, the officer in charge of the expedition, 35 axmen, 4 rockworkers, 2 cooks, and 1 foreman; for the packers, 1 chief packer, 12 packers, and one cook. An increase of the ordinary ration is absolutely necessary for the subsistence of employees engaged in construction work at this latitude. The strength of the enlisted men now on duty at the cantonment and substations—9 in number—should be increased, and an officer detailed to act as quartermaster and commissary of the expedition and to construct suitable quarters that would be at least comfortable for the command during the coming season.

In submitting this report I desire, in justice to myself, to call attention to the fact that it has been prepared entirely from my notebook, and from memory, and in advance of the reports of my subordinates. While the information submitted covers about all of value gleaned during the past season, it is not presented in so condensed a form as I would wish to have it, were the time at hand in which to review the subreports which are presented herewith.

Respectfully submitted.

W. R. ABERCROMBIE,
Captain 2d U. S. Infantry,
Commanding Copper River Exploring Expedition.

The ADJUTANT-GENERAL U. S. A.,
Washington, D. C.

REPORT OF CHARLES BROWN, QUARTERMASTER'S AGENT.

VALDEZ, ALASKA, *February —, 1899.*

SIR: I have the honor to report the following facts and conditions that have prevailed at this camp and the territory adjacent thereto:

On January 18, 1899, I started provisions, etc., underway to Station 24, with the expectation of landing them there in a few days. Since that time, however, the condition of the weather has been such as to prevent any further movement of these goods. The first cache remains 10 miles from Valdez, and am now awaiting every opportunity to move it up nearer the station. Soft snows, with the river open, followed by severe storms, prevented further progress, though indications are that we can now again safely resume work.

Many parties have of late been crossing the glacier, coming into Valdez from the interior for a change of food, etc. They report the condition of affairs there as being terrible; scurvy being the chief affliction, with many cases of frozen hands and feet. A number have died, and several with frozen limbs will lose them. I have had many requests for aid, medicine, and fresh food from physicians who have patients, and urge immediate action. In addition to those who have come out, it is reported the majority of sick are still in the interior and fear to make the attempt to cross the glacier. Those who have crossed have traveled in large parties for the sake of safety, and have encountered terriffic storms.

I have extended such assistance as has been possible, and after much difficulty succeeded in getting some green potatoes and sauerkraut over the glacier. Those who volunteered to take this in found it necessary to make three attempts to cross the glacier before they were able to do so, owing to the trail and storms. Two men died with scurvy while being brought over. They started from Saw Mill Camp and succumbed when near Twelve-Mile Camp. It is reported that 75 cases still exist between the glacier and Copper Center, many of whom will never recover. Those now coming into camp are mostly people who have been lightly touched with scurvy and able to reach Valdez without assistance. Their condition improves after reaching here, and many of them are waiting with the hope of earning something this spring by packing. Some of the number will return to the interior later, while others are anxious to return to their homes, though without the means to do so.

On February 23 a party of 25 started over the glacier, after being in Valdez long enough to fully recover their health. On the same day the "Poppy" party arrived here, most of them being frozen slightly about the hands and wrists. After being six days on the glacier they encountered a heavy storm and were compelled to dig a hole in the snow for shelter. On the summer trail Pete Benson lost his life in falling into a creek, being frozen to death before he could be removed to a place of shelter.

On February 26 W. E. Hendricks and George Hansen arrived here from Copper Center, bringing the report of the death of Robert Izatt, of Milwaukee, Wis; and also the further information that 27 men with scurvy of varying degrees of severity were bound here from the Chestochena and Saling rivers, and that Indians were bringing in two men from the Gakona River.

The Lower Copper River has not been exempt from scurvy. C. R. Waite reports a party en route to Alaganik with six patients afflicted with that disease; four of the number died on the way. Another party following their trail from the Bremner River had five cases of scurvy with them. February 24 intelligence was received that Dr. Logan was camped at the foot of the glacier with two bad cases of scurvy, the afflicted persons being Adolph Ehrhardt and Max Miller.

March 3 a relief party, consisting of Dempsey and Jackson, arrived here from the glacier with the bodies of Ehrhardt, Miller, Adolph Schultz, Eblerkamp, and Alleman. Eblerkamp's head was crushed when found, and the body of Alleman was found lying across the body of Eblerkamp. The bodies of Alleman and Eblerkamp were found in a deep crevasse. Although search was made for the body of Dr. Logan it was not found. Adolph Schultz was a resident of New York, and Eblerkamp formerly lived in Louisville, Ky.

understand, is equally serious. Many are wholly without means and dependent upon others for nursing, medical attention, etc. We are in need, too, of some medicines, and of any fresh fruit or vegetables which may be had at Valdez. Two have volunteered their services to bring in these supplies and are now on their way to Valdez. Several men are suffering with frozen feet, and amputations in a number of cases will, no doubt, be necessary. If it be within your power to give any assistance, I would respectfully ask your immediate consideration.

Thanking you in advance for the attention I know this will receive, I am, yours truly,

LEROY S. TOWNSEND, M. D.

The QUARTERMASTER'S AGENT, *Valdez.*

I have been unable to comply with these requests for medicines, having none on hand, even for use in this camp. If you could ship at once the medicines requested by Dr. Townsend in the inclosed lists, they would be of great value and go far toward relieving distress.

On March 6 the storm was still raging. Dr. Logan's body had not been found up to this time, though search has been made for it by different parties ever since. The steamer *Excelsior* came in and will probably go out to-day, providing they can make a landing for passengers.

Referring to the cache 10 miles up Lowe River, as before remarked, I hoped to move it further up as soon as that terrible storm of fourteen days subsided. Two days after the storm it turned warm, so that I could move neither one way or the other for five days. I at once decided to move the cache back to Valdez, and on April 14, took 1,800 pounds of provisions up to the north of the canyon. After that date the snow melted, so that no more sledding could be done from the lake to the canyon.

In my report of February I made mention of 27 destitute and scurvied people, and from March 5 to April 9, inclusive, 277 additional cases were reported.

Many of the parties who came in from the interior to Valdez were so weakened by scurvy they were obliged to come out to get fresh vegetables, etc., they have in caches in the interior.

On the evening of the 25th of April Mr. Knott and an Indian who had started from Copper Center for Valdez informed me about Dr. Townsend and an Indian whom he had left at the relief station, completely worn out and without food for two days. The Indian who came out with Mr. Knott belonged to Dr. Townsend's party. I at once informed you of their condition and was authorized to send relief to them. At 11 o'clock on the same evening, as soon as the crust on the snow had hardened sufficiently to allow travel, I sent John Fohlin and an extra man named Johnson with a dog team and provisions for their relief. They reached the relief station about 3 o'clock the next morning, and, after having breakfast, started back and arrived in Valdez about 10 a. m., on the 26th, with Dr. Townsend and the Indian.

Upon Dr. Townsend reporting to you that five sick men were left at Barrett's Camp, at the foot of the glacier, on the other side of the range, you authorized me to send at once two dog teams of four dogs each to assist in bringing the sick men over, and on 1 o'clock Thursday morning, April 27, I sent Ed. Woods and John Fohlin as drivers, together with seven extra men, John De Lander, A. Crawford, Joe Weckert, jr., Ed. Anderson, Rob Broughton, Rob Coles, and T. M. Johnson, who arrived at their destination about 7 o'clock p. m. the same day. On the next day, April 28, they were unable to start back on account of a storm. The glacier at this time of the year is something awful to witness, being composed of glaring ice, horribly broken up, leaving great yawning chasms and crevasses, forming huge "benches" almost perpendicular and extending to a great height. It requires the services of four or five men to assist a sick person on a sled down the steep "benches" and over strips of ice so narrow that a single misstep would launch one into crevasses hundreds of feet in depth.

On April 29, the storm having abated its fury, the relief party started back bringing the sick men, Schloegel, Hunt, Liljegren, Launert, and McCracken. They arrived at the Dempsey Relief Station about noon and reached Valdez at 7 p. m. of the same day.

On the morning of April 29, James Nucum came to me and reported that his partner, John Gardner, was at the relief station sick with scurvy and without food, and that he was unable to bring him in without assistance. Shortly after half past 10 on the same day, authorized by you, I sent seven men, Gus. Johnson, E. L. Lomnes, John Bornd, Bob Ferguson, Charles Morgan, F. H. Randall, and C. Anderson, to the relief station. They arrived there about noon and started back with the sick man, arriving in Valdez about 6 o'clock in you, who, together with myself, investigated the case and found that he had checks on deposit to the amount of $2,000 (twenty checks of $100 each) with the North American Bank, of New York City. He also had a certificate of identification, showing his signature and checks to be genuine. One of these checks was cashed by his permission, less 2½ per cent discount for cashing it, leaving him a balance of $97.50. Out of this amount was deducted $50 for hauling him over the glacier and taking care of him, the money to be divided as follows: Twenty-five for Ed. A. Erickson for taking care of him, $12.50 of which Erickson donated to one Ed. Woods, a very sick and destitute man, who has very little hopes of living, but who wishes to return, if possible, to Seattle, the remaining $25 to be distributed as follows: To F. E. Schloegel, one pair of socks, $0.30; R. P. Ferguson, one pair shoes, one pair drawers, $3.75; F. A. Campbell, one pair shoes, $4; C. G. Nelson, one suit underwear, $2; H. Hertzberg, one undershirt, $1.57½; C. Anderson, one undershirt, one pair shoes, $4.07½; O. Liljegren, one suit underwear, one pair socks, $2.55; B. Arden, one suit underwear, $2.55; James Ikes, one pair shoes, $3; Gus Johnson, one pair pants, $1.50; showing a total distribution of $50 distributed to the most needy and destitute as per your orders.

I am holding the merchant's receipt for the goods bought and the receipts from those who received the goods.

I also have the honor to report that the total rations issued to the sick and destitute from August 5, 1898, to March 29, 1899, is 9,675.

I also furnished to the relief station on the glacier from October 10, 1898, to March 29, 1899, 295 pounds of bacon, 475 pounds of hard-tack, and 20 pounds of coffee.

Lumber for the relief station and coal oil for stoves were furnished by the Steam Whaling Company.

The citizens of Valdez contributed all other necessary provisions and articles, including most of the coffee, extract of beef, stoves, candles, tea, salt, pepper, etc.

I also have the honor to report the following facts concerning the fish in Valdez Bay and streams running therein:

The little candle fish came in this year somewhat earlier than usual, being caught here as early as January. This is accounted for by the fact that Valdez Bay was not frozen over at any time in the season and the fresh-water streams and tributaries were open also nearly all winter, running under the snow. These fish came in in immense quantities and inhabited every little fresh-water stream in which they could spawn. We caught thousands here daily with little dip nets and also by hand. The run continues until nearly April.

The herring arrived this year in February, but were not so plentiful as last year. We caught a sufficient quantity, however, for our use.

They arrived in immense schools, but not nearer than the Islands and Swanport. These fish, unlike the candle fish, spawn in salt water.

Codfish and halibut follow in the wake of the herring, devouring great numbers of them. We caught plenty of cod, but very few halibut, the latter being a deep-water fish and found only on slopy bottoms. Most of the codfish were caught with the incoming tide and on a very short line. We also speared quite a number, finding them in places in water that did not exceed 1 fathom in depth. The halibut are caught near the sawmill, a distance of 9 miles from Valdez. This fish, like the cod, does not inhabit fresh-water streams.

Early in July dog salmon and humpbacks literally filled the streams. We speared them and shoveled them out of the streams. We could have thrown them out by hand, but they have large sharp teeth and are quite vicious. They were so abundant that we selected our victims and speared only the choice ones. In spite of the acquired prejudice against this fish as food, they make a dainty dish.

The silver salmon, the fish canned by all the canneries along the coast, are very plentiful here and are caught with seines in great numbers.

The salmon trout come in October and are sought after with great earnestness and activity. They make a most delicious meal. A pole, with two or three hooks fastened securely on the end, is all that is required to draw them out as fast as is desired. They are the prettiest speckled beauty we have ever seen. The sun shining upon them brings out their brilliant colors and shows them in all their beauty. They sport in their beautiful colors till winter closes the streams.

The first part of May was occupied in cutting and rafting wood across the bay to be used as fuel for the hospital, cook house, and camp in general. Gravel was also hauled and a walk built between the office shingles; 36 rafters, 2 by 6, 14 feet long; 800 feet sheeting. Hewed logs for floor joists. The station was built 2 feet above the ground. A wagon road was cut from station No. 2 to the foothills where the road takes the bar to Keystone Canyon. A trail was cut for surveying purposes. The Government steam launch was furnished with water and fuel whenever necessary.

On June 13 we removed the hospital to Swanport; took the lighter to the sawmill for a load of lumber and slabs for Valdez; cut trail from the end of wagon road for pack team, to avoid a deep stream.

June 22 we went to Swanport to cut firewood and piles and sawlogs and continued this work to present date. Fifty logs were rafted to the sawmill. Two hundred and one piles, from 30 to 50 feet long, were cut, peeled, and made ready for use. We also have on hand fifty logs for firewood.

The mowing machine and rake were taken from Valdez to the island to be used in putting up hay.

With reference to affairs at the hospital, Oscar Liljigren is going out on the first boat. John Gardner and H. E. Hunt are the only ones remaining. Hunt, with his frozen foot, is still black with scurvy from the ankle down. It will be necessary to amputate his big toe, but, on account of the scurvy, the operation must be delayed.

Schloegel and Gardner still have scurvy from the ankle down, but are on the way to recovery. They refuse to be put on the pay roll on account of not being able to do anything in the east and have plenty of supplies in the interior. Schloegel's supplies are on the Christochina River, about 200 miles distant from Port Valdez. Gardner's supplies are at Copper Center.

Respectfully submitted.

CHARLES BROWN,
Quartermaster's Agent.

Capt. W. R. ABERCROMBIE,
Second United States Infantry,
Comdg. Alaska Exploration and Relief Expedition No. 2.

REPORT OF LEROY J. TOWNSEND, M. D., ON SCORBUTUS, OR SCURVY.

Scorbutus, or scurvy, the most dreaded disease of the Alaskan prospector or miner, is a constitutional disorder, characterized by a vitiated state of the blood dependent upon the lack of necessary elements supplied through fresh fruit and vegetable nutriment. This lack or insufficiency in fresh vegetable material is the essential factor in its development. Another factor is the long-continued use of salt and smoked meats; the use of stale or unwholesome food still another. Indolence and inactivity are predisposing and mental lethargy or depression is undoubtedly active in its production.

The changes in the composition of the blood show a marked diminution in the potash salts, and, contrary to a quite general belief, the blood is not thick, but thin and watery. Indeed, to this watery condition may be attributed the discolorations which manifest themselves during the disease, the liquid condition of the blood admitting of its passage through the vessel walls into and beneath the skin. The development of the disease is usually slow and insidious. The unfortunate suffers from malaise and is indisposed to either mental or physical activity. Shortness of breath follows the slightest exertion, and palpitation of the heart is of frequent occurrence. Vertigo may be associated. Pain occurs in the knees or in the muscles of the calf or thigh, the muscles so contracting as to produce lameness. Œdema of urine is high colored, abnormal in quantity in many cases, and loaded, becoming highly offensive if left standing. Hemorrhage may take place from various mucous surfaces. Fever of a remittent character is a constant symptom, the morning temperature usually registering 99½° to 100½°. In the afternoon it reaches a degree or two higher. A good appetite usually exists, at least until the disease is far developed.

In such cases as progress unfavorably the weakness increases, the patient becoming unable to assist himself in the slightest degree. He soon lapses into a semicomatose or comatose condition, from which death relieves him.

Such complications as I have seen have involved the lungs and kidneys. I have had no case in which scorbutic dysentery has followed.

In diagnosis it would seem impossible to confound the disease with any other affection, especially when the condition is well developed. Yet the most astonishing errors were made in the Copper River region during the past year. Nor were these errors made by the laymen alone, but by presumably reputable physicians. For instance, one case that came to my notice had been diagnosed and treated as gangrene of the feet and legs, thought to have been produced by too tightly constricting the parts with cords used in tying gunny sacks over the feet and limbs. The marked extravasations were responsible for this mistake. The patient died. Again, another individual who had been unfortunate enough to have his toes frozen had the same cause placed on these offending members in explanation of scorbutic symptoms, which subsequently developed. Another individual, in which the disease was just beginning to manifest itself, was told that the pain and stiffness in his leg were due to a sprain, and the slightest swelling and discoloration of the gums were the result of "frosting" them.

In general, through the opinion expressed by several physicians, the impression was that the condition was rheumatic. Blackleg rheumatism it was called. This was a most unfortunate mistake. The line of treatment instituted in these cases was directly antagonistic to the accepted lines followed in scurvy, and such as subsequently came under my care responded very tardily to antiscorbutic measures. Under this impression, too, many had taken the trail who, had they known that the developing pains were the forerunner of scurvy, would not have done so. Many of these unfortunates had to be hauled back, and much suffering and inconvenience were the result. The only disease which might be mistaken is a rare one, known as peliosis rheumatica, or Schonlein's disease.

The above should be sufficient to place anyone on his guard, and, with reasonable discernment, he should be able to recognize the development of this dread malady.

In the consideration of treatment preventive measures should first receive attention. Citric acid lemonade should be used frequently—from one to three times daily. It may be either sweetened or unsweetened, and in strength corresponding with lemonade made from the fresh fruit. Lime juice may be used in the same way. Cider vinegar is of service. Dried or evaporated fruit and vegetable products will not serve as satisfactory substitutes. Canned fruits are of greater value. I would urge, too, that the Alaskan prospector and miner take a plentiful supply of milk, butter, sugar, and eggs (Lamont's crystallized). These articles should not be looked upon as luxuries; they are necessities.

On the interior a popular preventive and remedy was an infusion of pine needles. This was prepared by selecting limbs of young growth of the pine, stripping off the needles, putting in boiling water and setting aside to steep. Some boiled the needles for a considerable time, making a stronger decoction. Of this tea a fourth to a cupful was taken two or three times daily, as required. The inner bark of the willow and juniper berries were used in the same way. All of the above have proven of value. I did not prescribe them in my practice, but I am satisfied of their usefulness and they are worthy of remembrance.

In direct treatment the indication is to supply as far as possible the principles needed for the healthy constitution of the vital fluid, the blood, and to directly change the environment which tends to the development of the disease. Place the patient in the best possible condition for the invigoration of the system. If possible, let him take gentle exercise. Supply fresh fruit and vegetables, lemons, oranges, apples, potatoes, onions, cabbage, etc., together with fresh meat, if available. Lemons probably give the quickest results, and it is astonishing the experienced in controlling hemorrhage. In neither case was there manifest symptoms at the time of operation, but symptoms developed very soon after. Considering the blood changes, difficulty in stopping hemorrhage might be expected.

To my knowledge no cases of acute rheumatism, of typhoid, cerebrospinal, or other fever developed in the Copper River region.

Considering the hardship and exposure undergone, it is surprising that so little sickness resulted.

LEROY J. TOWNSEND, M. D.

VALDEZ, ALASKA, *May, 1899.*

REPORT OF THE WILSON MINING COMPANY, BY H. L. WILSON, JR.

The Wilson Mining Company, consisting of five men and an outfit of about 8,000 pounds, started from San Francisco March 1, 1898, and after a pleasant but uneventful trip, arrived at Seattle March 4, at 4 o'clock p. m. Being unable to secure a pilot for the inside passage north, our steamer, the *Valencia*, took the outside route. It began to blow before we were outside of Puget Sound, and the storm continued for eight days, growing worse all the time. The captain of the vessel said the sea was running about 60 miles and the wind blowing about 80 miles an hour. On March 13 (Sunday) the barometer indicated that the storm would grow worse; therefore, out of consideration for the passengers, 606 in number, it was deemed best to kill and throw overboard seventeen head of horses and cattle; also several tons of hay and grain that was loaded on the bow of the boat. This was done and the *Valencia* baffled the sea and wind much better. Our voyage is known as the awful trip of the Alaskan miners of 1898.

Tuesday morning, March 15, the weather was clear. We dropped anchor off Port Orca, Prince William Sound, Alaska, at about 11 a. m. At 7.30 p. m. over forty men were landed, most of them being bound for Portage Bay, as was our party, to cross the glacier into the Cook's Inlet country. We lay at Orca twelve days, awaiting transportation. On March 26 we received word of a good find on the Bremner River, a branch of the Copper. We then changed our plans and started up the Copper River, instead of waiting any longer for a boat to Portage Bay.

to take the party and outfits to Alaganik, or as near to that place as they could.

We started Friday, April 8, at 11 p. m., and were landed on 18 feet of snow on the marshes, about 3 miles from Goose Hill, which is about 8 miles from Alaganik. When we landed the sloughs were beginning to open, so we made haste to get off the treacherous ground. We worked until midnight, when a severe storm came up. It was so cold we were obliged to knock the boxes from our goods to make a fire. The next day we changed our camp to the timber in a higher part of the marsh. The storm continued until April 13, and the next three days it thawed. Saturday, April 16, at noon, the whole party made a start for Alaganik. There were thirty-two men in line. On the trail the trip was a hard one, as in crossing the sloughs we broke through many of them. We reached Alaganik about 7.30 p. m. and left that place Wednesday, April 20, for Spruce Camp, a piece of timber at the junction of the Copper River and the flats that border the sound. Thursday we finished caching our goods on the banks of the Copper River. April 21 we began to move up the Copper River. The first station is an abandoned trading post, known as "Bear House." We made the journey on the ice, a distance of 7 miles. From this place we went to what is known as the "Second Cottonwood."

On Sunday, April 24, it stormed very hard. Tuesday, April 26, we reached the Cottonwood camp with the outfit. Here we camped on 18 feet of snow, Wednesday, April 27, it began to rain. The snow became so soft we could not move.

On June 1 we started up the river at 2 p. m. The river has many channels, with bars and banks of quicksand and gravel between them. The channels are continually changing their course. After sixteen hours of hard labor we returned to camp, being unable to battle with the current and ice. On Friday, June 3, we made another start, this time going up the left channel. Coming to a high bank, we were obliged to pull the boat up the same by a rope. We finally crossed the channel to the flat on the other side, pulling from one flat to another and crossing streams when necessary. At 11 o'clock p. m. we camped about one mile from where we had started. Our boats leaked badly from being dragged over so many bars and coming in contact with so much float ice and therefore it was thought best to put back to camp.

Saturday, June 4, several parties arrived from Alaganik, landing on the beach near our camp. One of the parties was composed of 40 persons, the other of 18.

On Sunday, June 5, our company divided, 3 starting back to Odiak to go to Cook Inlet, but when they reached there they found many persons coming out, so decided to return home, which they did. The same day two men came down the river claiming to have lost all their goods at the rapids, and by their bad stories of the impossibility to boat up the Copper River succeeded in turning three or four others from one company. The company had hired these men to help them through and when deserted by them requested our assistance, saying they would reciprocate until we were above the rapids. We agreed to this proposition, and on Monday both parties (twenty-three persons in all) with nine boats started up the left channel and, upon reaching the high bank, cut a trail through the alders and, with five men on the head line and three on the stern, succeeded in getting our boats through the swift current, which we judged to be at least 10 miles an hour. The next day we were joined by a smaller party. We were all day getting the boats through this place. We worked, rain or shine. Now, for the first time, we came to a glacier stream, into which we were obliged to go and roll over large rocks in order to make a channel to get through hidden rocks about 10 feet from the bank to the middle of the stream. The glacier water runs swift, clear, cold, and deep, presenting a great contrast to the Copper River water, which is very sandy and muddy.

We were obliged to overcome difficulty after difficulty, cutting trail most of the way, before our boats could proceed.

On June 12 we were just below the Childs Glacier, on the right bank of the river. At 4.30 a. m. we commenced to line our boats past the glacier. Here the river is composed of one stream and, in places, runs very swift. It is about one-fourth of a mile wide. The glacier at this time of the year is along the water's edge. It is about a mile and a half long and 150 feet high. It is supposed to be moving forward. The opposite side or bank is a long rocky beach. When the glacier "dumps" it throws a swell varying in size to the amount of ice that falls. We sent our first two boats up on the rocky beach, and another and 2 miles wide, with large icebergs floating in it. We rowed across this lake to what is known as the left hand slough, where we found quiet water and a good camping ground, sheltered from the wind. The party of 40 went still further up to the foot of the rapids on the left bank. At this time of the year the water is high and runs very swift. We tried many times to line up the rapids, but failed. Two large snow slides on this bank also came down to the water's edge, hanging over the waters about 25 feet, ready to fall at any moment. We tried in vain to get the boats past them. As only alders grow in the vicinity of the rapids, we could not build boats above and pack the goods over.

On Thursday, June 16, we were located in front of Miles Glacier on the left side of the stream. The water rose at the rate of from 1 to 5 inches in twelve hours. This rise or fall in the water of the slough means a rise of as many feet in the rapids above.

June 17 20 men came down the river from Bremner with reports of no gold to pay and water too high to get to bed rock. Some of the men tried to shoot the rapids, taking an Indian to guide them. The boat was lost and they escaped with their lives only by assistance from shore. Substitution of the boats above the rapids was commenced for those below. Bedding and personal effects were packed over the trail, which is very bad, having two snow slides to cross and three rock cliffs to scale, about 200 feet above the raging waters, with a rock ledge of not more than 2½ inches wide for the feet and about the same for the hands.

July 4, conditions being more favorable, we began to move up the rapids, taking with us a boat load of about 1,000 pounds, calculating to put a rope across the rapids and stretch it above to use as a ferry. In this we failed, the water being too swift for us to cross. We then put 5 tons of goods about half way up the rapids, thinking to make the crossing when the water became lower. Men were pulled into the water and the boats broke away many times.

July 10 the water began to rise again and there was no opportunity to get the goods over the rapids.

July 21 we commenced to put goods past the face of the Miles Glacier, following close to the rocky flat on the opposite side of the lake. It takes about seven minutes for a swell to reach this side after a glacier has dumped, thus giving the men time to protect themselves. Four of our best boatmen took the goods across the rapid stream, which flows from the cataract above. From here we packed up a high, rocky side of a dead glacier, about a mile distant, then through 4 miles of alders and rocks to the head of the rapids, which we reached with all outfits August 12. During our stay of about fifty days in the vicinity of the rapids and glaciers it stormed twenty-four. The river at this place resembles a large lake, but has quite a current. We waited until August

24 for wind in the right direction and quantity to push us against the current, as we could not row against it with a loaded boat. While here we have seen the river rise 7 feet in twenty-four hours and fall 15 feet in the same length of time. The water of the Copper River flows in swells at times, as the wind blows in gusts, and at times little headway can be made even with a sail. August 25 we passed through Mead Canyon, which is dangerous on account of swift water and rocky cliffs. August 27 we made camp about 2 miles above Bremner River, on an island in the Copper River, and then returned for the remainder of our cache, arriving at this island again on September 3. On September 5 we moved to another island 3 miles further up the Copper. The next day it rained and blew down the river, the water raised, and the current was so swift we could not move. On September 15 the wind changed, but the storm continued. We started out and made about 10 miles, but our companions in another boat were left on the flats. Here the sloughs or streams get so small and so many gravel bars—falls (for they have a positive drop of from 1 to 2 feet) that we resorted again to lining our boats. Ice-cold and swift water, quicksand, gravel bars and high rocky cliffs to finger or rope around, with an occasional sandstorm, were the principal obstacles we had to encounter. October 1 we reached Wood Canyon, another almost impassable barrier of the Copper River. We were the first party to pass up through the canyon this year. October 3 we started with a light load about 8 a. m., three men in a boat, and by rowing, fingering, and roping, crossing back and forth to avoid the currents—swift water being the main difficulty—we reached the bar above about 6.15 p. m.

On October 7 we started up the river above the canyon. Again one has the same kind of bars, cliffs, and swift water to contend with.

October 23 we shot and roped down the rapids, landing safely about 3.30 p. m. We found it impossible to go down the right slough, it being dry. The main slough from the rapids on the left, in which is the cataract, was blocked with icebergs at the lower end; in fact the whole lake or basin before the Miles Glacier was a mountain of ice, making it impossible to get over that way. Therefore we unloaded our goods and rolled the boat over the rocky bar or flat for a distance of about 3 miles on rollers made from drift logs, and then packed our goods to boat. A windstorm commenced the morning of the 23rd. It was blowing down the river and getting colder, but we were anxious to push on, as we knew the way so well. All went well until the current we were to follow turned to the right and led in a direction that would take us to the Copper River Flats and so out to the sea. The storm was too strong for us and we were blown into the ice float on the left, and, try as we might, we could not keep out of the slough to the left and were kept from landing by the slush ice. We seemed to be in the very center of the storm. It kept blowing harder and getting colder. The moon came out, and some time after sunset we were able to get our boat to the right side of the stream, where we found a blind slough and pulled the boat in for the night. We crawled under the boat and waited for morning, hoping that the storm would abate. Daylight brought no change. The water had receded 100 feet from the boat, upon which the wet sand and gravel had frozen 3 inches from the bottom. We tried in vain to get the boat free. At this time the wind was blowing from 50 to 80 miles an hour. To get our bearings we started for the right side of the river, as the storm was raging so one could not see a distance of 20 feet, owing to the dust, sand, and gravel. It blew gravel stones as large as No. 4 shot, and one required a staff to walk against the storm. We reached an island covered with alders, somewhat sheltered from the storm. We were then opposite Spruce Camp, only 8 miles from Alaganik. Fully believing that there was but one slough between the island and the mainland, it took us until night to get some of our effects from the boat.

The next day we started for the river, calculating to build a raft and make the other side, but we found five sloughs instead of one, and no drift. We then built a brush house, put up a signal, built a fire, and camped. We soon ran out of grub, and could only wait for the storm to abate. On November 22 we were successful in getting to the other shore, and started for Alaganik. When about half way we met two men out hunting and asked them for something to eat, as we had nothing for several days. They were of a party of nine men who had also been blown wrong by the storm which came down the Copper River. After giving us some beef tea, the entire party started for Alaganik, which, owing to open sloughs, we did not make until November 3 about noon.

The natives told us that these winds continue down the Copper River until February. We stayed at Alaganik until November 7, as the sloughs were frozen too hard to proceed by boat, and not hard enough to proceed by sled. We were obliged to go over the marsh to Eyak Lake, which we understood was frozen hard enough to hold. On November 8 we had much difficulty in crossing the glacier streams, but made the lake by dusk. As it was thawing, the guide thought it best for us to go across a certain point, where we could make Alaganik by land, but as we neared the point of land the ice gave way and all went through into the lake, but again landed safely. One sled load of goods stayed in the water all night. A cold sleet was falling and we built a fire and waited for morning. November 9 we built a raft and secured the sled we could not get out of the ice the night before. We then took a small pack and started for Eyak, at the head of the lake. Odiak, which is just across the arm of land between the lake and the sound, we reached about 12.30 p. m. The storm started in again more furious than ever and continued for four days. We then went to Orca to await a steamer for the States. On the 21st of November we started in a small sailboat for Valdez, at which place we landed November 25 about 10 p. m.

H. L. Wilson, Jr.

FROM PORT VALDEZ TO KLUTENA RAPIDS VIA VALDEZ GLACIER.

SIR: According to your orders, I submit herewith a report of my trip from Port Valdez to Klutena Rapids via the Valdez Glacier. My orders were to proceed to Klutena Rapids and there establish a relief station.

I left Port Valdez Thursday, May 4, at 3 a. m. The party consisted of Private Garrett, John Fohlin (dog driver), and myself. We took with us a dog team of five dogs, provisions, sleeping bags, and other articles necessary for the trip.

After traveling some 4 miles we reached the foot of the glacier, but, to our great disappointment, we found no snow whatever there. The glacier at this point was covered with rocks, caused by the many snow-slides from off the mountains. We were compelled to pack our outfits up over the second bench. The dog team was hardly able to pull the empty sled, the ascent in several places being nearly perpendicular. On our arrival at the second bench we again packed our outfits on the sled and proceeded on our way until we reached what is known as the "relief station." The station consisted of a skeleton frame with a tent stretched over it, constructed by Captain Abercrombie in the spring of 1897 for the relief of parties crossing and recrossing the glacier. Upon our arrival at the station we found an oil stove and the necessary cooking utensils. We also found a large amount of hard tack, placed there for the use of unfortunates detained on the glacier for any length of time.

On leaving here we continued on our journey, but had not traveled far before encountering a blinding snow storm. However, the trail was easily followed and we felt no alarm whatever. We finally reached the foot of the summit, after having traveled some 15 miles. Here was located another relief station, and upon entering the same we found a prospector. This man started to haul his cache back to Valdez, but becoming snow blind was compelled to take refuge in the relief station. He informed us that he had been living on the glacier for some nineteen days, and had given up all hope of ever getting off, being physically and mentally broken down. We waited at the station some time for the storm to abate, but the longer we remained the fiercer it raged, so we concluded to make an attempt to cross the summit that evening. After travelling some few rods from the station we fully realized how difficult was the task we had undertaken, the summit being some 4,800 feet high and the ascent some 1,500 feet to the mile. At this time it was impossible to find the trail, much less make any headway, as the snow was about fourteen inches deep. The storm had changed to a raging blizzard and we were unable to see any distance ahead of us. We would often be brought to a halt on the edge of a crevasse an hundred feet deep. At last, after several hours' hard travel, we managed to reach the foot of the glacier. Arriving there we found three more prospectors, who had pitched their tent at that point, being afraid to venture across the summit until the storm had abated. One of the party had contracted scurvy and was unable to travel. The only possible way for him to reach the coast was for his partners to sled him across the glacier, which I afterwards learned they did.

We again found the trail and had no trouble in getting down to Barrett's camp. After resting there for a few minutes, we continued our journey.

At the foot of the glacier we found some ten or twelve cabins, all deserted with the exception of one. Upon going up to this one, we found an old German, who seemed very indignant at us for disturbing his sleep. We learned that the night before some miscreant had broken into his cabin and stolen a considerable portion of his cache, including his gun and ammunition. Upon telling him that we were connected with Captain Abercrombie, he concluded to take us in for the night.

The following morning we resumed our journey. The snow had become soft, and it was tortuous to continue for any distance, so we concluded to make the Saw Mill Camp and remain there until the weather should clear; but, unfortunately, it did not clear as we expected, and we were obliged to remain here for two days and two establish another station at Copper Center for the relief of those prospectors in and around that locality, as well as for those coming down the Copper River.

After establishing a station at the rapids and leaving Private Garrett in charge, we started on our return journey to Valdez, about 1.30 a. m. May 10. The weather was delightful, and the snow having a fairly good crust we were enabled to make exceptionally good time until about 1 p. m., when the crust became soft. We then resorted to snowshoes until after crossing the summit of the glacier, where the crust was again sufficiently strong to sustain our weight without the use of the snowshoes. After trudging along for about seven hours, we arrived at the relief station, where we concluded to remain over night rather than take any chances in trying to get down over the third bench. This third bench is one of the most dangerous points on the glacier, owing to the many crevasses and snowslides. The following morning we left the relief station and proceeded to Valdez. The trail was fairly good until we reached the second bench, where we were again compelled to pack our outfit down to the foot of the glacier, and from there we sledded our outfit to Valdez, arriving there at 1 a. m. May 11, 1899.

JOHN F. RICE.

Capt. W. R. ABERCROMBIE,
Commanding Copper River Exploring Expedition, Alaska.

REPORT OF FIRST LIEUT. WALTER C. BABCOCK, EIGHTH U.S. CAVALRY, FROM APRIL 26, 1899, TO OCTOBER 9, 1899.

SIR: Pursuant to instructions I have the honor to submit the following report on the location and construction of the Trans-Alaskan Military Road:

Orders of April 26, 1899, placed me in charge of the substation along the military road. Station No. 2, the first one constructed, was some 16 miles east of Valdez at the head of the flood plain of Lowe River at the base of the mountains **(29, 30)** near the entrance **(27)** to Keystone Canyon. This substation was established on April 29, when the first pack train left Valdez **(26)**, carrying rations and camp equipage. The train was composed of 30 pack horses, each loaded with 200 pounds; 2 horse sleds, 6 packers, 2 sled drivers, 1 camp cook, and myself.

Our route was southward over the flats at the head of Valdez Bay 2½ miles, thence eastward up the flood plain of Lowe River, crossing and recrossing the river and its branches many times **(90)**, a distance of 14 miles to the entrance of Keystone Canyon. After leaving the tidal flats at the head of Valdez Bay much snow was encountered **(91)**, which, toward noon, became soft, the horses sinking to their bellies. Wallowing through this snow continued for a distance of 9 miles, or three hours, after which the snow gradually became less deep, the last 3 miles being over bare, frozen gravel bars, making the trip a hard one on heavily laden unshod horses.

the building. The walls and ends are made of spruce and cottonwood logs, 12 to 16 inches in diameter, notched together at the corners of the building and further secured by stout wooden pins. Rafters for the roof were strongly braced to support the great weight of snow in winter. The roof was boarded with 1-inch lumber and carefully shingled. Crevices between all the logs of the walls and ends were chinked with dry moss, driven in tightly and held in place by trianglar strips of split logs on the outside, thus making a water-tight building. The building has one door and two windows. A soldier was detailed as storekeeper in charge of the supplies at this station. Dr. Neil C. Trew (**101**), acting assistant surgeon, United States Army, and Mr. E. M. Westervelt (**102**), clerk, arrived, and took station at this place, making a total of 25 men at the camp.

Work on the storehouse was pushed, regardless of weather, as it was important to get the stores under cover without delay. From noon of the 4th to noon of the 7th of May it snowed almost continuously, covering everything with four inches of soft-snow slush, making all the timbers wet, and considerably delaying the work. Working hours were from 7:30 a. m. to 11:30 a. m., and from 1 p. m. to 5 p. m., making eight hours per day, Sundays excepted. In six days the building was practically completed, with the exception of the roof boarding and shingling, the material for which had not arrived.

CONSTRUCTION OF THE ROAD.

Meanwhile Mr. Palmer, topographer, was at work looking for a suitable line for the road and blazing it out for the brush cutters. On completion of the storehouse, work on the road was begun over the line as blazed by Mr. Palmer. This line started from the gravel flat, a quarter of a mile west of the storehouse, on the north side of Lowe River Valley (**28**, **45**), and ascended the mountain with many switchbacks and turns in order to maintain a suitable grade. The ground was frozen to a depth of 5 feet, and from 6 to 8 feet of snow encountered. Work was consequently slow and results for the first mile were most discouraging. Near the summit of the first ridge, at an elevation of 700 feet above the valley, so much snow blocked the way that it was labor wasted to dig through it. Work was, therefore, temporarily abandoned on this part of the road, and the construction of a back trail along the sidehills of the valley to Valdez begun. This was continued for 1½ miles when work on the forward trail was resumed.

In the spring and early summer a road along the sides of Lowe River Valley from Valdez to station No. 2 is unnecessary, as the river is easily fordable at all points. At this early date the valley was still more or less covered with snow, which prevented determining the course of Lowe River. This is why work on the road was begun from station No. 2.

Mr. Palmer's work was not satisfactory. His location for the road was faulty, and he failed to prepare a suitable map for the region traversed by the trail. He was relieved from his work May 25 and ordered to Valdez, and myself detailed to determine the location of the road and to prepare the topographical map of the route and the adjacent country.

By the 26th of May work had progressed so far that much time was lost by the construction party in going from and coming back to the camp, and it became necessary to establish a new construction camp nearer the working party. A new camp site (**103**) was selected, 2 miles from station No. 2, and one-half a mile in advance of the trail as cleared and graded, and a temporary trail for the pack train cleared over this advanced portion. May 26 (Sunday) camp was moved to the new site. It was at this point that the real difficulties of road building began.

The new camp was near the edge of Keystone Canyon, on the only spot within 3 miles where a site for so large a camp existed. Keystone Canyon extends from north to south for about 4 miles, flanked on both east and west with steep mountains 4,500 to 5,700 feet high (**32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 47**). On the east side the walls of the canyon are from 800 to 1,300 feet in height and very steep throughout. Near the middle of the canyon is a sheer rock precipice, one-half mile in length and 800 feet high, departing but a few degrees from the vertical. On the west the canyon wall is nearly vertical to a height of from 300 to 450 feet, above which the slope is less steep, thus forming a natural bench, more or less well defined. It is along this bench that the road is built. In several places the rock walls of the canyon extend above this natural bench, and through these ledges the road had to be cut. Between station No. 2 and the end of the can-to blaze the actual line through the timber and thick brush. The work of this party was the most exhausting of all.

On the steep sides of this canyon the brush, mainly alder, grows in a dense mass, twenty feet or more high, and is twisted and intertwined in an inconceivable tangle. The heavy snows of winter bend these bushes down to the ground and give them such a set that, when the snow disappears in the spring they stand out from the ground at an angle of about 40 degrees. Thickly interspersed with this alder brush and growing straight up are devil clubs, covered with sharp, barbed spines. The effort of climbing over, under, and through this brush on a side hill so steep as to scarcely afford a foothold; falling, stumbling, grasping at the devil clubs; bruised and beaten by the stout alder branches, and, at the same time, endeavoring to blaze out a line with a uniform grade or on a level is simply inconceivable to one who has not tried it. Frequently this has to be done many times before a line is secured that is considered the best possible. The first trip of this kind along the sides of Keystone Canyon required six hours to make three miles, and this was followed by the return trip, over a slightly different line, back to camp. This was done four times before the present route was selected.

Every inch of the route has to be covered by an advance party in this way before the work on a new section can be commenced. The country is full of surprises. In one case, without a personal investigation on my part, I took the word of one of my men who had been in advance, that a straight transit line could be run through a dense cottonwood forest for 2½ miles in a direction to reach a glacier stream at the point selected for a bridge. On running the transit line for 1 mile I came to a swamp and bog, not of great extent, but so large as to necessitate a change of route. The man in advance had passed through the timber and brush a quarter of a mile nearer the mountain and, crossing no stream, had very naturally concluded that the ground was dry and solid farther out. The result was a delay of one and a half days and a lesson to myself. Thereafter I never failed to go over the line in person before deciding on the route.

On a new and untouched portion of the route the axmen preceded, clearing the ground of all brush, trees, and fallen timber. They were followed by a second party, with picks, crowbars, and shovels, that graded the trail, often cutting deep into the side hill to gain the necessary width for the road, and removing all obstructions but the heavier bowlders and the solid rock. The rock workers followed with blasting powder and drills, and removed all rock too heavy or hard to be moved and broken up by picks and bars. Lastly came two or three men with sledge hammers, who broke up fragments of rock left after blasting and scattered it along the road as ballast.

As the work through the canyon progressed, the working party was too far away from the camp to return for the midday meal and, there being no other camp site nearer the working party, two men had to be detached to carry out the food.

The mountain sides were so steep that the axmen had to support themselves by hanging to the brush with one hand while they chopped with the other. At times the graders had to make vertical cuttings of 15 and 20 feet in order to gain a horizontal width of 5 feet for the road. In the first 4 miles from station No. 2, fifteen mountain streams were crossed. Eleven of these streams ran in deep gullies, across which retaining walls were built, and the space thus inclosed filled up with loose rock through which the stream could pass. One wooden bridge was constructed in this section. Work over the 4 miles through the Keystone Canyon was the most difficult of any encountered during the season.

It was necessary to rush the work as rapidly as possible to get the post-office inspector, Mr. Wayland, and his outfit, and Mr. Rohn, topographer, and his party through. Eleven additional men were employed and put to work June 12, so that at this date there were twenty-four men on the work.

On June 16 two packhorses belonging to prospectors were led over the road coming from the interior of the country; and at 5 p. m., Saturday, June 17, the trail was ready for the pack trains to go in. The road through 4 miles of this canyon, the key of the whole route, was constructed in thirty-five working days.

Sunday, June 18, a train of 5 horses went over the road to the interior, and the following day were followed by 38 more pack horses and 9 dogs (**81, 82, 84**), 22 of the horses and the dogs belonging to the expedition.

Once through the Keystone Canyon the valley turns to the eastward side a natural rock abutment was found, opposite to a spot where a crib could be constructed on bed rock. This crib was put in place and many of the longer bridge timbers cut before the main working party reached this point.

This bridge is a type of all the larger bridges constructed along the road (**46**). The crib is of rough rhomboidal shape, the acute angles pointing up and down stream, and is built of large spruce timbers notched together at the corners, and is of such a height as to place the deck of the bridge some feet above highest water. The inclosure thus formed is filled with large bowlders and rock. The deck of the bridge is supported on five spruce stringers, 14 to 16 inches in diameter at butt, and resting on the crib and natural abutment, a span over the stream of 38 feet. From the crib to the cut bank of the stream, a distance of about 30 feet, four stringers were laid, all of them notched and pinned firmly to the crib. On the stringers were laid crosswise logs, 6 inches in diameter, cut to lay close together and notched to rest solidly on the stringers. Every 5 or 6 feet one of these was pinned at both ends to the outer stringers. On the top were laid side rails at either side, also pinned down. The projecting ends of the cross timbers were neatly sawed off.

By the 18th of July over 8 miles of road had been constructed from station 2 and to within 4 miles of the summit, including four bridges, two of them over 60 feet long, 617 yards of rock had been blasted and 600 yards more broken up and moved by hammers and bars. Retaining walls across narrow ravines had been built and the whole trail graded and ballasted. This work had been accomplished in one and one-half months, over the most difficult part of the route, with an average of 15 working men.

In the construction of bridge No. 4, that over the second glacier stream (**52**) emptying into Dutch Flat, there were many difficulties to be met. At this time, the middle of July, the streams were high. This one was some 50 feet wide and 10 feet deep at the bridge site and rushing through at a speed of 14.7 miles an hour. Timber of a length sufficient to cross this stream with one span could not be obtained in the immediate vicinity, and consequently three cribs had to be constructed. The first, a low, small one, was on the shore; the second was placed in the stream, one-third the distance across. It was built on shore, 10 feet high, of the largest timbers, and was made very strong to withstand the enormous force of water and the blows of large cakes of ice brought down from the glacier. It had to be moved out into the stream through the boiling, swirling water, to a depth of 5 feet and there sunk and ballasted with rocks and bowlders. The first attempt was a failure, the crib being washed away before it could be secured in place. The second attempt succeeded. The third crib was near the farther shore, in slack water. Most of the stringers for the bridge were found only on the farther shore, at a distance of from one-half to three-fourths of a mile from the stream. The trail had not been cleared on the farther side and the brush had to be cut away for each log from the place where it lay down to the stream before it could be hauled to its place. The total length of this bridge is 112 feet, with four spans, the largest 38 feet.

From this bridge to the summit of Thompson Pass (**48**) the road ascends by a nearly uniform grade of about 1 in 10. Thompson Pass, the lowest practical route over the divide between Lowe River and the Chena, has an elevation of 2,840 feet and rises above the river 2,100 feet. From its summit down to the Chena, a distance of about 7 miles, the drop is only about 700 feet, along Ptarmigan Creek.

For 1 mile from bridge No. 4 work was comparatively easy, there being but little grading necessary and but few streams to cross, practically the only work being to clear the route of brush and fallen timber. The next three-quarters of a mile was along a steep hillside between what is known as the first and second benches. The line for the road was over enormous bowlders, of many tons weight, covered with deep moss and vegetable mold and the whole overgrown with alder and devil club. Clearing the brush and scraping away the moss revealed great gaps and crevasses between the bowlders, which had to be filled with broken rock and the corners of the bowlders broken off. This rock is of a light-green color and very hard and heavy. Drills were frequently broken and two men were kept constantly at work at the portable forge resharpening.

Arriving at the second bench the work again became easier and the brush much lower and less thick. The last 2 miles toward the summit are practically free from brush and the ground hard and no work was required.

ADVANCE LOCATION FOR THE ROAD.

By the middle of July I found it necessary to personally determine the route for the road far in advance of the working party, and on the 27th left the construction camp with a small party for that purpose. My instructions were to prepare a topographical map of the country traversed, locate the route for the road, making careful measurements of the distance, and continue the photographic work along the route selected for the road, making careful measurements of the distance, and continue the photographic work along the route selected for the road. I was to proceed as far as possible and return to Valdez not later than October 15. I made my outfit as compact and light as possible and took with me Mr. Worthington as a transit man, and two packers, one to work as a rodman for Mr. Worthington and one to cook and care for the horses while in camp. Four strong pack horses carried our sleeping bags, shelter tents, two changes of clothing, thirty days' rations, camera and supplies therefor. The transit, level rod, axes, rifle, and shotgun were carried by hand.

From the summit of Thompson Pass my route was down Ptarmigan Creek to the Chena, the south fork of the Tickell River. The descent to the Chena is about 7 miles, with a gradual drop of about 700 feet. The ground much of the way along Ptarmigan Creek (**108**) is soft and boggy and is crossed by many small glacier streams. All of the Alaskan glacier streams, be they large or small, should be treated with the greatest respect. The last one feeding Ptarmigan Creek from the west came near being disastrous to my expedition. (I cite the case as illustrating the force of one of these smaller streams.) The stream at this time was only 15 feet wide and 18 inches deep, but very swift. I was ahead and forded it without mishap. Mr. Worthington, who was carrying the transit and shotgun, with a small hand ax fastened in the waistband of his trousers, followed, and was about to step out on the farther shore when his legs were struck by a moving bowlder and his feet carried from under him. He disappeared in the ice-cold water, his hat floating off downstream faster than I could run. After a few minutes' struggle he crawled out on the side from which he had started. He still had hold of the gun, but the transit and hand ax were gone. He could not be induced to attempt a crossing at that point again, but finally crossed half a mile above and near the foot of the glacier. The sharp points of the transit legs were pointed down stream when he lost his hold, and I believed it could not go far without lodging against a bowlder or snag in spite of the swift current. All search, however, was fruitless, and we went on to camp, intending to start early the following morning, when the stream would be lower, and attempt to turn it to a new channel. This we could have easily done. Fortunately, such labor was unnecessary, as on approaching the stream one of my men discovered the legs of the tripod caught in a snag 450 yards below where the mishap had occurred. It had been in the bed of the stream for fourteen hours and bodily carried down a quarter of a mile and was sadly injured; but none of the parts whose use could not be dispensed with were injured or, as we believed, out of adjustment, a conclusion that has since been verified by the makers, to whom it was sent for repairs on my return.

To follow down the Chena along its bottom for any great distance was impossible. It was a larger river than any I had yet encountered. At the mouth of Ptarmigan Creek and for some miles below (**53**, **54**) it flows over a wide gravel bed in many channels, all too deep or swift to be forded at this season, often coming close (**110**) to the steep ridges that limit its valley on the south side.

The crossing of Ptarmigan Creek at its mouth was difficult. We accomplished the crossing by loading two of our horses with light loads and then leading them across, riding the other two animals and then returning for another load. Six trips were made in this way before all our supplies and ourselves were landed safely on the other side. From this point the hard work of the trip began. My two packers were sent on ahead to look up a route down the river along the ridges to a suitable camping place and cut out a trail through the brush for the horses.

Meanwhile Mr. Worthington and myself extended the map up the Chena some miles and looked over the vicinity for a suitable route for the road. I finally decided on a line on the east side of Ptarmigan Creek, high up on the mountain sides and descending by a slight grade to the Chena Valley. This location avoided a crossing of Ptarmigan Creek and placed the line far above all soft ground in the bottom, crossing the glacier streams where good fords could be made.

"The Major's," was a foot log across the canyon, placed there and used by prospectors. The width at this point was about 40 feet. Not far distant from this point good timber was found in abundance. It was here that the bridge was finally located (**57, 58**).

The impossibility of getting my horses over the stream on a foot log obliged me to keep on the south side of the river and follow along the rocky ridges that run parallel to the stream. Before determining on the place of the foot log as a suitable site for the bridge, I decided to explore the canyon farther with the idea of possibly discovering a better site. My horses were sent ahead each day by the easiest route, while Mr. Worthington and myself followed with the transit and mapped the country.

The thick brush and rapid current of the river made it impossible to locate points by triangulation by working back and forth across the valley, and resort was therefore had to careful stadia measurements for distance and the results plotted at once. By proceeding in this way an absolute measured base line was available at all times from which horizontal and vertical angles to all visible points could be measured. This method was followed from the beginning to the end of my trip. The work was slow, as the brush had to be cut away for nearly every sight with the transit, but I believe this method gave the most rapid progress consistent with reliable results. The map was also complete each day up to the point where work was stopped for the night.

The canyon of the Chena continues for about 5 miles below this foot log, widening occasionally, but narrowing down again. Near the lower end of this canyon I found a second place where a bridge could be built. Here there were rocky points 8 and 10 feet above the water extending into the stream, making the span about 45 feet. I did not attempt to decide which was the better of the two sites, as so much depended upon the nature of the ground below the upper site on the farther (north) side of the river, and this ground I had not explored. The main point was that sites for a bridge existed. A report of the work of my party and a description of the bridge sites were sent in about this time by returning prospectors. Below the Chena Canyon the valley widens again, and the stream spreads out into many channels and flows over another gravel flat (**109**).

It was now the 3d of August. The stream was at its highest and bringing down cakes of ice from the glaciers at its head. The "Major's" foot log had been washed away. One of my horses with a 200-pound pack had fallen into the stream from a cut bank and was carried down 60 yards and nearly drowned before he could be rescued. I began to be worried about effecting a crossing safely with our stock and supplies. Fortunately the weather was cooler and cloudy for two days; the glaciers ceased to melt and the river began to fall slowly. I lay over in camp one day, anxiously watching a gauge I had placed in the stream. The river continued to lower, and on the morning of the 5th of August I made preparations to cross.

My plan was the same as that followed in crossing Ptarmigan Creek. The horses were loaded with light packs and led over. On the return trip for another load we got into quicksand near the shore and the horses deliberately lay down in the water. The wetting was far from pleasant, for the water was ice cold, and I could not delay the crossing long enough to get dry. Several trips were made in this way. On the last trip, Paulson, one of my packers, became confused by the swirling water and proceeded down stream for a quarter of a mile, "fording the river lengthwise," as he afterwards expressed it. I remained at this new camp all day to give all hands an opportunity to dry clothing and to give our horses a rest.

From this point our route lay over the divide between the Chena and the Kanata (**109**), the South and North Forks, respectively, of the Tiekell. The passage of this divide was entirely free of brush, for a recent forest fire, still smoldering in the fallen logs as we passed, had cleaned the ground of this obstruction. The absence of all underbrush was amply compensated for by the charred and half-burned spruce trees laying crossed and piled up on all sides. Through this tangle we had to cut a path for the horses with small hand axes. It took hours to cover the 3 miles to Stewart Creek or River, the last tributary of the Chena from the northwest. I venture to say that a dirtier, more tired lot of men were not to be found in all Alaska than that composing my party.

We remained camped on Stewart Creek for several days while the section was mapped down to the junction of the North and South close in under low-cut banks, while on the other shore opposite each pool is a broad brush-covered bar (66). The brush on both sides overhangs far out into the stream. Its current is less rapid than that of the other streams we had passed and its channel is constant, there being no evidence of any recent change.

Steep mountains lie on either side, 6,000 to 7,500 feet high. The valley is covered throughout with fine spruce and cottonwood timber, with a dense undergrowth of scrub willow, alder, wild currant, and wild rose. Along this valley the timber line extends much higher up the mountains than it does nearer the coast, reaching an elevation of 3,000 feet. The brush disappears at an elevation of about 4,000 feet. On the coast about Valdez Bay timber is rarely found at an elevation of 1,000 feet, and the underbrush disappears at 1,800 to 2,000 feet. In a general way, it may be stated that the brush line is about 1,000 feet above timber.

It was along the Kanata that we made our slowest progress. It required five days to run the stadia measurements over the 7 miles from Stewart Creek to Bowlder Creek, near which our next camp was located. On one day we traveled only three-quarters of a mile in distance, and throughout the trip up this stream we had to cut the brush before stadia measurements could be made. Half a mile below the mouth of Bowlder Creek were the ruins of Tiekell City, which was for a short time a flourishing settlement of shacks and tents and a population of forty persons, including the mayor. A forest fire had swept down on the settlement before my arrival and had left but two tents and the "waterworks" intact. The waterworks consisted of a canvas bucket suspended on a rope across the river, with a line by which it could be hauled in and out. On a board nailed to a tree I read the following:

> Pop. before fire 39.
> Pop. after " 5.
> SMITH, *Mayer*.

This was somewhat ambiguous, as it left one in doubt as to the fate of thirty-four persons. Added to these statistics was a caution about carefully extinguishing all camp fires. The ground was strewn with coffee and tea tins, baking-powder cans, half-burned beans and pease, axes and tools of all kinds, gun barrels and pistols of all makes, buckets, gold pans, valises, charred clothing, etc.

Along the banks of Bowlder Creek some prospecting was being done and a little desultory placer mining, without any paying results. At this place we succeeded in regrinding our hand axes and appropriated a shovel and a long-handled axe, which I felt would be useful in the future.

Fine flour gold is found in all the tributaries of the Tiekell, but it is too fine to be saved by ordinary panning or rocking, and nowhere sufficiently plentiful to pay for the labor of working a claim. The

Tiekell Valley had not been penetrated by prospectors till the preceding fall and winter, and yet the banks of the Kanata, or North Fork, and its larger branches were everywhere staked off into placer claims, each with a location notice written on the stakes. Most of these claims were abandoned; at least, there were no evidences of any assessment work having been done.

Beaver dams were frequent along the Kanata, but all the beaver had been killed off. This stream ought to be a fine trout stream, but no trout or fish of any kind have ever been found there, or, in fact, in any of the tributaries of the Tiekell. Long, swift rapids below the main forks of the river prevent the fish from coming up from the Copper River.

From Bowlder Creek my route was over the Quartz Creek Divide and down that stream to the Tonsena River. This was not to be the route for the road, but I desired to survey the Quartz Creek Valley and Tonsena or Archer Lake, which lies just above the mouth of Quartz Creek, neither of which had ever before been mapped. Leaving Bowlder Creek, we climbed nearly straight up the sides of Mount Rice, the average slope of which is 40 degrees, over a trail cut the month previous by a party under Mr. Rice and Inspector Wayland. After reaching an elevation of about 4,200 feet, and well above the brush line, we turned northward and proceeded along the mountain side a distance of 3 miles to a point near the source of Quartz Creek.

I had hoped to push down on the other side to some spot below the timber line before making camp. However, the men and horses were so tired from the hard climb, and the hour was so late, that I stopped for the night. Nothing in the shape of firewood was to be found except some stunted willow brush 18 inches high, and green at that. Out of this we got enough fire to cook bacon and boil coffee, and then southwest. At the mouth of Bear Creek is a mining camp of eight or ten log houses and the post-office of Belcaro, the latter established by Post-Office Inspector Wayland late in June. Mail was carried back and forth from Valdez once a month during the summer by one of the community, who received for his services $1 from each person sending or receiving a letter. Upper Quartz Creek is about 1 mile wide and very boggy in summer, the soft, wet ground extending well up the mountain sides, even where there is a considerable slope, the thick moss holding the water like a sponge. Half way down the soil becomes gravelly, the stream is more confined, and a short distance below Bear Creek flows through a deep canyon for a mile or more. Below the canyon the valley again widens and gradually merges into the broad timbered flats that border the Tonsena.

Along Lower Quartz Creek much placer mining was going on. The stream in many places was turned from its bed, and rockers and sluices were frequently met, all being worked. One claim was yielding 57 cents to the cubic yard, possibly a hydraulic proposition, but hardly paying the expenses of hand work. Something over 4 ounces of gold was the result of the season's work up to the 20th of August.

To pass the canyon of Lower Quartz Creek we were again obliged to make a steep ascent to an elevation of 4,000 feet, shortly to descend again to the creek bottom below the canyon. Arriving at Tonsena Lake near its outlet I made camp, intending to remain in this vicinity several days, while I surveyed the lake and the river above and below.

Tonsena or Archer Lake lies in a picturesque valley (**111**), the mountains rising abruptly from the water to a height of 6,500 or 7,000 feet on all sides except the north (**112**). The lake is irregular in shape, with a decided bend toward the west, and has its greatest length of 9 miles from north to south, with an extreme width of about 2½ miles. At the south end of the lake the Tonsena River empties into it and is its main supply stream. Several other smaller streams empty into the lake from both east and west, and all, with one exception, Manker Creek, are glacier streams. Consequently the waters of the lake are crowded with fine glacial silt. The ground at the head of the lake is swampy and overgrown with tall, rank grass, which is a favorite hiding place for hundreds of ducks of all kinds. The valley above the lake narrows considerably, but is still of sufficient width for some miles to form the bed for many smaller lakes, which line the river on both sides (**113**).

Toward the northern end the mountains gradually recede from the lake (**112**), and at the outlet the valley is about 3 miles wide, thickly grown with spruce and cottonwood, and with a dense undergrowth. The banks of the river below the lake are low and flat, and frequently swampy. Below the lake there are no large tributaries of the river. The only stream of consequence coming from the west is Manker

Creek, which empties into the lake a mile from its outlet. On the east side there are three streams, all of them running clear, reaching the Tonsena River between the lake and a point 23 miles below.

At the time of my arrival there were three mining camps about the lake, two of which were on the east shore, one being near the head of the lake at the mouth of Hurtle Creek, and another near the outlet, called Wesley City. My camp was about three-fourths of a mile below this metropolis. On the west side of the bank, at the very mouth of the lake, was the third camp, the proprietor of the latter operating a ferry for a consideration. The Tonsena River and all its branches abound in salmon, and all the streams, large and small, are crowded with the finest brook trout, from 10 to 14 inches in length and beautifully marked. In the timber along its shores grouse are plentiful and the southern end is a great bear country. Wild red currants grow in great abundance all about the lake, surpassing in size and flavor any cultivated berries I have ever eaten. Many other varieties of berries are found here—the salmon berry and raspberry, blueberry, black currant, and others; but none are so plentiful or can compare in flavor with the red currant.

To facilitate the survey of the Tonsena Valley, I hired a small folding canvas boat, the only kind of craft to be found. During the first three days at the lake the wind blew very strong and cold, directly down the lake, from the large glaciers near the source of the Tonsena. The waters were very rough, and to venture out in this small boat was foolhardy. During this storm we crossed the river and worked downstream, following wherever possible an old Indian trail, formerly much used.

While camped at the lake I sent one of my packers and two horses to the Government cache on the Klutena to get food supplies. My

Valdez, the courier following the route taken by my horses. Orders were also received directing me to proceed back to the Kanata and follow up that stream. I accordingly left the lake August 27 and proceeded back up Quartz Creek, stopping long enough to survey Bear Creek and Rainbow Gulch. From the Quartz Creek summit I descended to the Kanata over a route that brought us to that stream some 4 miles above where we left it on the advance. This route is known to prospectors as "The Drop," and has a very steep descent of 2,100 feet. Here, along the mountain sides, above the brush and in open parks in its midst, grows a fine, rich grass. Forty tons of this grass were afterwards cut and hauled down to the stream to where a log stable was later constructed and in which horses of the expedition were to winter.

I camped near the foot of "The Drop" at an abandoned camp of the Manhattan Mining Company. Their tent (about the size of an army wall tent) was standing, but in a dilapidated condition. Inside, at the end opposite the entrance, were two rude bunks, one above the other. A floor was laid of small jack-spruce trunks, unsquared, but stripped of bark, and a small sheet-iron stove, with wooden legs, stood in the "summer kitchen," just without the main tent. In a log cache near by were several old valises, some old clothing, and a sack of beans. A well-worn trail led from the tent down a steep cut bank to a beaver pond, from which the proprietors evidently obtained their water. Indications were that this had been a permanent camp. In the vicinity were several prospect holes, one of them being 20 feet deep and about 12 feet square. I describe this camp for the reason that it is typical of the abandoned Alaskan prospector's camp. The owners had either left the country or were at work in the Government trail gang, earning sufficient money to pay their passage back to the States.

Our progress up the Kanata was very slow, owing to the thick brush, our measurements averaging but little more than a mile per day. I might have avoided this brush by traveling high up on the mountains, but considering the time lost in getting up and the necessity of again descending before going into camp, our progress would have been but little increased. Besides, the actual line for the road would have to be explored in any case, and this line closely followed the west bank of the stream.

It was at our next camp, some 4 miles above "The Drop," that we experienced a severe earthquake shock. This was on Sunday, September 3, at 2.28 p. m. It was a new experience and not a pleasant one. I realized at once what was occurring and carefully noted the duration of the shock. It began gently, gradually increasing in violence until it became impossible to stand erect, and then gradually decreased. The shock lasted one minute and ten seconds. The vibrations were from north to south and were so violent that one could actually see the ground move. Cook pails resting on the ground were upset and tall spruce trees about us swayed dangerously. The sensation experienced was not so much that of fear as of utter helplessness, accompanied by a slight nausea resembling seasickness. After the shaking had subsided we heard eight muffled reports, sounding more like distant gunshots than any other sound, occurring at intervals of about twelve seconds. At 7.30 p. m. there was another light earthquake, lasting three seconds, and preceded by one of the reports above noted. It was reported to me some days later that Tonsena Lake dropped 2 feet after the shock, but this I had reason to doubt. On the following Sunday there were six more earthquake shocks, commencing at 7.08 a. m and occurring at irregular intervals up to 11.45 a. m. The last was the most severe, and lasted over a minute. After the last one we again heard the peculiar reports above noted.

Some 3¼ miles above this camp Fall Creek empties into the Kanata, and just below its mouth is a mining camp of four tents. It was here that we crossed the Kanata to its east side. At this settlement were three vegetable gardens, where radishes, turnips, and lettuce had been successfully raised without any apparent nursing on the part of the owners. As it was now late in the season, many of the radishes had gone to seed; yet on the 5th of September we found enough to make a mess for my party. The lettuce was in prime condition and still untouched by frost.

Fall Creek and Ernestine Creek are the two largest branches of the Kanata, and both enter it from the southeast, their mouths about 2 miles apart, and both have their sources in glaciers. Gold has been found in paying quantities in both streams and claims on both of them were being worked at this time.

Above the mouth of Fall Creek the valley of the Kanata widens

The source of the Kanata is a swamp, thickly overgrown with dwarf willow and sparsely timbered with small but tall spruce trees. The elevation of this point is about 2,300 feet above sea level, making the ascent from the forks of the Tiekell, a distance of about 18 miles, only 800 feet. The divide between the Kanata and the South Fork of the Tonsena is a low ridge, imperceptible from any distance (114), and would be difficult to locate without actually going over the ground. Both streams have their source in swamps. Two men in a few hours could dig a trench connecting both streams. To do this would be a public-spirited act, as it would be the means of filling the Kanata and the Chena and their branches with the finest kind of trout and salmon.

Arriving at the head of the Kanata a courier came in with orders for me to send my horses, which were in fine condition, back to the construction camp to help out in the main supply train. This I did on the 7th of September. To go on without the horses was impossible, and I therefore remained at this camp for six days, when four new horses arrived.

In the meantime the valley of the Tonsena South Fork, or Mosquito Creek, as it is sometimes called, was thoroughly explored on both sides. This valley is from 1 to 2 miles wide, and bounded by steep mountains 6,000 feet high. Its direction is northwest, and throughout its entire length of about 20 miles it is an immense swamp, grown with thick dwarf willows 6 to 8 feet in height, with patches of timber here and there. To cross this swamp is a difficult task, as I found to my cost. I was wet from head to foot, and the legs of my trousers were torn off at the knees. New, strong duck trousers might have withstood the trial, but mine were far from strong at this date. I believe it impossible to get a horse safely across this bog.

On the west side of the valley is an old Indian or Russian foot trail. It had evidently been much used at one time, as there were numerous signs of brush cutting done many years ago, and the trail for long distances was worn down a foot or more below the natural surface. This trail was followed for 3 miles, when it turned to the right and evidently crossed the swamp. However, no further trace of it could be found on either side.

About this time a man named Tjosvig, who had been in this region in the preceding fall, reported to me as a packer and cook in place of one whom I had discharged. He stated that a pass existed through the divide between this valley and Bernard Creek, the next stream below, a pass which, if practicable, would shorten the distance to the Tonsena some 3 miles, and besides, by avoiding the trend to the northwest of the South Fork, give a more direct route to the road. My first exploration of this pass, which I named Kimball Pass (115, 116), led me to the conclusion (and I must admit it a hasty one) that this route was not feasible, because of the additional ascent of 1,600 feet.

I decided to run the line down the South Fork of the Tonsena when new horses arrived, and instructions were received to push on as rapidly as possible to the Tonsena River, clearing the trail of brush as we went. Arriving at the Tonsena I was to select a site for a storehouse and cabin and meet parties coming from Tonsena Lake who were to build it.

To make a proper beginning for this trail cutting it was necessary to go back to the crossing of Ernestine Creek, half a mile in the rear. Only one long-handled ax was with my party, and this had been picked up on the way. The one lost by Mr. Worthington in the glacier stream shortly after the start was later replaced by a small hand ax, picked up en route, weighing 1 pound, and hardly more effective than a toy. Three other hand axes were with my outfit, thus making one ax, large or small, for each member of my party, there being five of us at this time. The ground had already been thoroughly looked over for 5 miles in advance before the order to clear trail was received, and we therefore commenced at once.

About 1 mile per day was our average progress. Eight miles had been cleared when the ground became soft and boggy, although the line was some 300 feet above the valley bottom. The outlook ahead was most discouraging, there being still some 12 miles more of this work before reaching the Tonsena, and I decided to once more make an examination of Kimball Pass. To do this thoroughly I believed would require a long day's work. I took with me 2 men, carrying 1 meal each, the camera, shotgun, and surveying outfit. We started at 4.30 a. m. and traveled continuously until 6.30 p. m., having made a circuit through Kimball Pass, down Bernard Creek a long distance, and then again through the divide over a saddle known as Big Stone Pass, 5,600 feet high, and thence along the mountain side the route I had followed, leaving his gun, bedding, and food with them. He had not reached me, and was now a week overdue.

The route down the South Fork of the Tonsena, as I explained to the cabin builders, was not practicable, and consequently a Government cabin at the mouth of that stream would be useless. A delay would be caused by changing the route to the next valley, making our arrival at the Tonsena so late in the season as to render the completion of a cabin extremely doubtful. Messrs. Johnson and Grogg had decided to give up the contract, but I persuaded them to make one more effort. I accordingly agreed to meet them at the mouth of Bernard Creek on the Friday following, promising them the use of my horses to get their stuff down to that point. Early the following morning they departed, and my own party set out for Big Stone Pass, this being the shortest route to Bernard Creek and lying far above the brush line. I determined to push on as far as possible down Bernard Creek, abandoning all survey work, in order to reach the Tonsina on the date agreed.

By 3 p. m. we had made 10 miles, and shortly after got into the brush so thick that our horses could go no farther. Here I made camp. The next day all four of us started for the Tonsena, turning the horses loose at the camp and carrying only the shotgun, a small package of pea-soup powder, and a half-gallon kettle. The cut banks of the Tonsena appeared about 5 miles distant, but turned out to be somewhat more than 9 miles away. This was through the densest brush and for the last 2 miles over an enormous windfall of spruce and cottonwood timber. It was 3.30 in the afternoon when we arrived at the river. There were no signs of the cabin builders. I afterwards learned that they did not reach there until the following day.

I selected the cabin site on dry ground near the river in a grove of the largest, tallest spruce trees. Near the site was plenty of good moss with which to chink the logs and considerable good grass. I then hung my handkerchief on a tree overhanging far over the stream, and set up a post on a small gravel bar near by to attract the attention of the builders as they came down the river. On this post I marked the distance and direction of the cabin site. At the latter place I blazed a large spruce tree all around and marked with a lumberman's pencil thereon in a manner that could hardly fail to attract attention of anyone in the vicinity. In this tree I stuck a pencil note, stating that I could not get my horses through in time to assist in getting the builders' supplies to the spot before the season closed, and also gave the location of my camp up Bernard Creek.

Bernard Creek differs from the South Fork of the Tonsena in having its source in a small lake (115) on the summit of Kimball Pass at an elevation of 4,000 feet and being more confined in its course. It is about 20 miles long and flows through a narrow valley with a gravelly soil, thickly grown with a tough wire brush. Its lower half is between high-cut banks, broken at frequent intervals by deep ravines. Along its banks and along the Tonsena near its mouth grow the largest of spruce trees, 100 feet or more high and many measuring 3 feet and over in diameter at the base. The Tonsina Valley about the mouth of Bernard Creek is of a similar character, but much wider with the cut banks averaging 250 feet in height.

Nearly opposite the mouth of Bernard Creek another stream, known as Trout Creek, empties into the Tonsena, its valley being like that of Bernard Creek. At this point is a good bridge site, and the route up Trout Creek is in such a direction as to reach the Klutena River at the point selected for crossing, some 8 or 10 miles above its mouth. The last mountains on the Coast Range lie on the east side of Trout Creek and separate it from the Copper River Valley. I do not think this route for the military road could be improved upon. The distance is the shortest to the crossing of the Tonsena. The ground is good all the way from the head of the Kanata; the grades are light and the line up Trout Creek to the Tonsena is over a low saddle with very light grades.

To get back to my camp before 5 o'clock, when darkness set in, was now impossible. We made a start, however, and succeeded in making about 3 miles to a small stream before darkness overtook us. Here we prepared to spend a disagreeable night. We had eaten nothing except half a cup of pea soup apiece since breakfast. All day we had seen but one grouse and this had been shot. This one small bird, without pepper or salt, was to make a meal for four hungry men. While there was still a little twilight left we all engaged in hauling dry wood to our fire to last us through the night. We had no bedding nor coats with us, and the nights were now quite cold, ice form-following day. The grass was already poor and scarce. No sooner does the frost touch it than it becomes as useless for forage as so much straw. Just as we were turning in for the night we heard three shots fired as a signal. Thinking they came from someone who had lost his bearings, I had them answered. Shortly afterwards we heard shouting, and in a few minutes Dr. Trew, the surgeon of the expedition, came into camp followed by the courier who had been seeking us so long. They both brought me orders, the one verbal, the other written, to turn back and take charge of the construction camp, and to continue that work as long as the weather permitted, but in any case not later than the 15th of October. It was now the 30th of September, and, as above stated, I had already decided to take the back trail the following day. Dr. Trew and the messenger were both in a sad plight and very cold. They had come 17 miles that day from the mining camp below Fall Creek on the Kanata, over Big Stone Pass and down Bernard Creek to our camp. The shoes of Mr. Rothkranz, the messenger, were worn through to his bare feet and his canvas trousers torn to a fringe below the knees. On the summit of the pass and all the way down the north side they encountered much snow. During the day this had soaked their foot wear and clothing, and as the air became colder on the approach of night their trousers and shoes were frozen stiff. Neither had mittens or gloves. It was a fortunate thing for them that they fired their signal shots when they did, otherwise they would not have found my camp. In the thick brush our camp fire could only be seen a short distance, and the chances of their coming directly to it were slim indeed.

The next day, October 1, dawned bright and clear, and I regretted that I had to go back. However, to have failed to heed the warning of the snow would have been foolish. For the safety of the men and supplies I had no apprehension; the men could travel anywhere, even with the snow lying deep; the valuable surveying instruments and camera could have been safely cached, and what provisions, photographs, and notes I had could have been carried by all hands, as there were now six of us. With the horses, however, it was different. The grass was poor and constantly becoming worse, while the work of the animals would increase with the depth of snow, and as their strength failed they would be able to carry less and less. Had I pushed on ten days longer not a horse would have gotten back. It was snowing every day on the summits and high passes, and it was the passage of these divides that would wear the horses. In the valleys there was no cause for apprehension, except the poor quality of the remaining grass.

As we neared Big Stone Pass I climbed to a low summit near by to get photographs of the Copper River Valley. It was a most remarkable day for this region, so said Cris, my cook, who had done much prospecting in this region the preceding fall. The atmosphere was unusually clear and the high snow-covered mountains of the Alaskan Range, 200 miles to the north, were clear-cut against a deep-blue sky. To the east the Mount Wrangell group stood out clear from base to summit. Mounts Drum, Tillman, and Sanford had not a cloud about them, a most unusual condition, while the puffs of white, steam-like smoke from the volcano Wrangell were sharply outlined against the sky. Here was the photographic opportunity of a lifetime and I exposed many plates. All of them, for reasons that I explain in my photographic report, were utter failures.

The trip back to the construction camp was over the route followed on the advance and was uneventful.

The third day I intended to lay over and give the horses a good rest so as to make the remaining distance of 16 miles in one day. It snowed hard all the preceding night, however, and I thought best not to delay. We nevertheless made the entire distance on this third day. The snow as we neared the main camp became less and less.

Arriving at the camp, which was near the above-mentioned Manhattan Mining Company's tents, I took charge of the camp and the work. A large log stable was under construction and about half completed, capable of holding fourteen horses. Near by was to be built a cabin for the two men who were to care for the horses. This stable was about 2½ miles in advance of the camp and near the river—the Kanata. Forty tons of hay had been cut high upon the mountain sides and was to be hauled down to this stable when there was sufficient snow to permit the use of sleds.

The food supply at the construction camp was low, there being only enough for five days more. The stable builders were also about out of food and threatened to quit work. The completion of this stable horses came in. This train I ordered back, first sending two horses to the camp of the stable builders with more food.

We camped that night in the snow without tents, each man choosing his own bed place. Dr. Trew, at his own request, I sent on to Valdez, to take in word of our coming. It snowed hard during the night and the horses got but little food.

The next day's trip was a long one of 16 miles to the relief cabin on the Chena, situated a mile below the mouth of the canyon. The workmen walked ahead to break a trail through the snow for the horses. Everything depended upon saving the horses from useless exertion till we reached the storehouse at station No. 3. Near the relief cabin was the camp of some eight men, who were constructing the cabin. This cabin was completed on the afternoon of my arrival. All the tentage, camp equipage, and tools were carefully stored in the loft of the cabin, and I had signboards placed at the branch trails leading from the main road to the cabin. The following day the pack loads were rearranged to accommodate the bedding and clothing of the eight extra men. Many of the men carried packs on their backs. We crossed the Stewart Creek Bridge and the long bridge over the Chena and followed up that stream to a point 2 miles above station 3, the nearest point at which grass for the horses could be found.

At station 3 I left with the soldier storekeeper all the surplus food brought in by the last supply train, so that the horses might all have light loads for the passage of Thompson Pass. At station No. 3 a destitute prospector applied to me for permission to ride, he having both knees sprained and unable to walk any distance. He had done favors for me while I was camped at Tonsena Lake, and I granted him permission. Mr. Worthington was taken ill the following morning and also had to ride. Two horses were unable to carry packs from weakness. On the ascent (118) to the summit of the pass another horse played out and his load was distributed among the rest. On and near the summit there were about 30 inches of snow. I had a double force of men with the train to help the horses through the drifts, while most of the remaining men went on ahead to break trail for the train, a work that they willingly performed, realizing as they did the loss of their bedding and clothing if the horses played out. Guns and much clothing were carried by hand. The summit was passed without further trouble. The view of Dutch Flat from the summit was most surprising. For 100 miles on the north side I had come through snow from 6 to 30 inches in depth, while in Dutch Valley there was no snow whatever, and much of the brush and cottonwood timber was still green and untouched by frost. The snow on the divide became less and less deep, and disappeared entirely at about the 2,000-foot elevation.

A stop for the night was made near the camp of Mr. Gillette (**104**), the railroad engineer of the expedition. A short march of 8 miles was made next day to station No. 2, and the following day, October 10, the train reached Valdez without mishap.

SUMMARY OF CONSTRUCTION WORK.

Total length of road—	Miles.
For pack horses	93
In excavation	35
Cleared and grubbed	67
Cleared only	12

Twenty-six bridges were constructed, exclusive of small culverts, with a total length of 856 feet. The largest bridge is 121 feet long. These bridges have forty spans, the longest span of 40 feet being in the bridge over the Chena Canyon. Two bridges have four spans each, and three others have two spans each. Eighteen spans measure 25 feet or over. Nine log cribs were constructed. Twenty-one thousand two hundred and twenty-four feet of logs were used in stringers and sills. These bridges have a width of 9 feet.

The width of road in excavation varies from a 5-foot to a 10-foot roadbed, the narrowest part being in Keystone Canyon.

The width of clearing and grubbing varies from 6 feet to 35 feet, and averages about 25 feet. The narrowest part, viz, the 6-foot width, is in the advance 12 miles, and was made only of sufficient width to permit passage of pack horses.

COMPARATIVE COST OF CONSTRUCTION AT PRICES COMMON THROUGHOUT THE UNITED STATES.

5,000 cubic yards solid rock, at $1	$5,000

REMARKS AND RECOMMENDATIONS.

In the above narrative of the work of the advance location party for the Trans-Alaskan Military Road I have omitted many instances which occurred of a humorous or provoking nature, as being unessential to the official topographical description of the terraine and the climatic conditions of this portion of Alaska. Such adventures and mishaps as I have recorded have a certain descriptive value—my only excuse for inserting them in an official report.

If it is contemplated to resume road construction and exploration during the season of 1900, with a view to obtaining results commensurate with expenditures, it is imperative that the work be begun much earlier in the spring than has been the case on previous expeditions.

In order to begin location work at the earliest possible time, viz, the date of disappearance of the snow, it is necessary that before that time supplies be cached at the various substations along the road. Not only must food supplies be on hand, but at the present advance end of the road must also be the tentage, camp equipage, cooking outfit, etc., required for a working party of say forty-five men, all told. Of the material of this description left over from last season's work, 90 per cent was condemned by me as worn-out and unserviceable. The food supplies now at station No. 3 and beyond are no more than necessary for the winter's consumption by the various station keepers. In order to get such supplies to the substations in time, resort must be had to dog sleds, say five dogs to a sled, each team capable of carrying about 100 pounds to each dog. It is apparent that this hauling must be done while there is yet a solid crust to the snow. Up to the latter part of April this crust is hard day and night, but after that date the crust melts in the daytime, though still freezing hard at night. This latter condition lasts until about May 10, after which there is an interval of some three weeks when neither sleds nor horses can be used.

In order to insure the proper provisioning and equipping of the substations, I believe it necessary that the expedition be at Valdez not later than the first week in March, and earlier, if possible. Cribs for the bridges over the Tonsena, the Klutena, and the Tazlena ought to be placed in position early in the season before the glaciers begin to melt and the streams get high.

As the length of the road increases the problem of supplies at the front will become more and more difficult of solution. With an unlimited supply of pack horses there could be no trouble in this respect, but in Alaska such unlimited supply can hardly obtain. The reduction to the smallest number of horses going with exploration parties to be away the whole season is an important factor, as thus leaving a larger number of animals permanently with the main supply train. This result can be accomplished only by the purchase of supplies in the interior early in the season, as was done the past year, or by packing them in by dog trains before the snow crust melts.

As to my own party the past season, the time gained by having such food supplies in the interior I have already explained. It was of equal value to the party under Mr. Rice on the trip from Valdez to Fort Egbert, on the Yukon, and to the party of Mr. Rohn, topographer, who explored the Chettyna and Upper Copper valleys.

To avoid unnecessary wear of horseflesh, I would suggest that a system of relays be adopted for the pack train by dividing it into three trains and working each train back and forth over the same portion of the road between certain substations. This would entail the employment of some six extra packers, but would, I believe, prove economical in the long run. It would give shorter trips for the individual horse and a quicker service.

I submit herewith a topographical map of the region traversed by the military road, and in advance of the road as far as the proposed crossing of the Tonsena.

PHOTOGRAPHIC REPORT.

On reporting for duty with the Copper River exploring expedition at Seattle, Wash., April 7, 1899, I took charge of the photographic work, by virtue of the authority conferred in the following letter and verbal instructions from yourself:

War Department, Adjutant-General's Office,
Washington, March 22, 1899.

Sir: I have the honor to inform you that orders to-day direct Second Lieut. W. C. Babcock, Eighth Cavalry, to report to you for the purpose of accompanying the exploring expedition of the Copper River, Alaska, provided for in General Orders 51, current series, from this office.

The Assistant Secretary of War directs that Lieutenant Babcock be placed in super-

The camera employed, a 5 by 7 "Universal," had all joints secured by brass screws, in addition to the usual dovetailing and glue. Carrying cases for the camera and plate holders were made of strong, light wood, one-half inch thick, thoroughly seasoned, and made with hinged overlapping lids. These were lined with heavy canton flannel and covered with strong leather, strengthened with brass corners. These boxes were inclosed in cases made of the thickest canvas, with overlapping cover, all edges and covers being bound with leather and the whole secured by two leather straps and buckles, one of the straps serving as a handle.

The dry plates used, the most positive on the market, were shipped in the ordinary pasteboard boxes and were damp proof to a certain extent. I took the precaution, however, when in the field, to have my spare plates securely wrapped in oilcloth bags, made to fit. The rolls of film used in the smaller cameras were, according to your own suggestion, inclosed in tight-fitting cylindrical tin boxes and the cover joint secured with adhesive tape.

A printing paper unaffected by dampness was employed, and was selected rather for the simplicity of its manipulation and its sensitiveness to either daylight or artificial light than for the excellence of its results.

On April 26, at Valdez, a small board shack 7 by 8 feet was purchased for use as a dark room and for the storage of the photographic materials. It was fitted with shelves and made light-tight and served its purpose well throughout the season's work.

Picture making for the expedition was begun with the loading of supplies and stock on the steamer *Excelsior*, at Seattle, April 14, 1899, and was continued until the return of the expedition. Five small kodaks were included among the supplies, and these, after detailed instructions as to their use, were furnished to parties entering territory not covered by my own party. In all, some 400 negatives were taken. Sets of prints were made from these, one set being retained for record and other selected prints forwarded as exhibits accompanying preliminary reports to the War Department.

As far as possible negatives were developed shortly after making, in order that mistakes could be corrected and accidents avoided. The want of a suitable portable dark room and the consequent delay in the development of negatives is the cause of the utter worthlessness of many valuable views made by the location party, far in advance of the main camp.

It is said that a good photograph of Mounts Drum, Tillman, Wrangell, and Blackburn has never been made. I saw these mountains under remarkable conditions of the atmosphere and climbed to a height of 5,500 feet to obtain an unobstructed view, and made five exposures. On another occasion I made six exposures from a different point. They are all utter failures. According to all traditions of photography, they would be well-nigh perfect were it not for an unavoidable delay of six weeks in their development.

Photographs serve the purpose of illustrating in a general way the features of a landscape, but they come far from filling all the wants in that respect, and can never compete with a hasty, yet skillful, pen-and-ink or even pencil sketch. Perfect landscape photographs—that is, those that give to all objects the same degree of prominence that they present to the eye in the actual view—can be obtained only by repeated trials and long waiting for favorable conditions of light and shade. In an expedition of this kind it is manifestly out of the question to make many delays for experiment or to obtain the most favorable actinic conditions.

Occasionally circumstances arise when a view showing clearly far distant details is desired. It is generally difficult and frequently impossible to effect this by photography. In such cases a hastily executed pen-and-ink sketch is the only resource.

I submit herewith a set of prints of all negatives made by this expedition, except such as are partial failures or so nearly duplicates of others as to render them unimportant. As far as possible, the date of taking the negative is marked on the print, in order that it may show the effect of the seasons on the landscape.

METEOROLOGICAL REPORT.

Upon the arrival of the expedition at Valdez a rain gauge and maximum and minimum thermometers were adjusted and set up in suitable spots and soldiers instructed in their use and the method of reading them. Shortly after the establishment of station No. 2 another set of instruments was placed at that point.

METEOROLOGICAL RECORD.

Monthly summaries for Port Valdez.

Month.	Temperature.					Precipitation.			Number of days.			
	Mean maximum.	Mean minimum.	Mean.	Maximum.	Minimum.	Total.	Greatest in 24 hours.	Total snow	With 0.01 inch or more rain	Clear.	Partly cloudy.	Cloudy.
						Inches.						
May	52.74	33.41	43.07	64.00	27.00	2.88	0.45	Slight.	14	7	7	17
June	57.16	41.93	49.54	74.00	34.00	3.11	1.50	0.00	14	7	12	11
July	....	46.87	....	....	30.00	2.75	1.08	0.00	9	19	1	11
August	....	41.83	....	....	31.00	4.19	1.73	0.00	19	10	8	13
September	....	34.66	....	....	15.00	8.71	1.24	0.00	20	7	4	19
October *a*	....	25.00	....	....	15.00	4.52	1.70	26.70	10	9	6	12

a Record closes October 27, 1899.

Monthly summaries for station No. 2.

Month.	Temperature.					Precipitation.			Number of days.			
	Mean maximum.	Mean minimum.	Mean.	Maximum.	Minimum.	Total.	Greatest in 24 hours.	Total snow.	With 0.01 inch or more rain.	Clear.	Partly cloudy.	Cloudy.
						Inches.						
May *a*	53.76	34.26	44.01	65.96	27.10	....	....	....	....	....	....	....
June	59.03	42.43	50.73	74.90	33.01	1.66	0.24	0.00	15	13	2	15
July	69.06	49.19	59.13	86.90	42.10	2.21	.55	0.00	10	19	4	8
August	61.25	44.67	52.96	73.00	37.00	3.07	.53	0.00	13	13	4	14
September	59.30	37.83	48.56	74.00	29.00	5.46	.58	0.00	19	10	0	20
October *b*	....	30.07	....	....	18.00	1.26	.85	3.00	6	11	1	14

a Rain gauge not set up until May 26, 1899.
b Record closes October 26, 1899.

Respectfully submitted.

WALTER C. BABCOCK,
First Lieutenant, Eighth United States Cavalry,
In Charge of Location and Construction Party.

Capt. W. R. ABERCROMBIE,
Second United States Infantry,
Commanding Copper River Exploring Expedition.

REPORT OF OSCAR ROHN ON EXPLORATION IN WRANGELL MOUNTAIN DISTRICT.

TRAILS AND ROUTES.

The key to the Copper River country and to its future development was the discovery of the Lowe River passes and the construction of the military road from Port Valdez to the interior. It is true that the natives have for centuries reached the coast by way of Copper River, and that hordes of prospectors in the season of 1898 reached the interior in part by this route, but mostly by way of the Valdez Glacier, the only other route then known. But either of these routes is so difficult, dangerous, and impracticable for general travel as to be prohibitive to a thorough investigation and development of the mineral resources of the area. The discovery and improvement of the new route not only makes possible the shortest, easiest, and most direct connection between the Yukon district and the only good American port on the Alaskan coast, but it makes possible an investigation and development of the vast mineral resources of which the Wrangell Mountains and their eastern continuations give promise. The trail has been completed over the difficult and questionable part of the route, and by way of it the prospectors can now reach Copper Center with a pack-train load of goods in the same time that it would take him formerly to make his way with a light load to Copper Center from Valdez, while the transportation of his goods involved months of labor with the firmer and furnishing the best footing, but involves crossing the western branches of Copper River, two of which, the Chestochena and the Tazlena, are considerable streams and during the flooding season are difficult to cross.

The discovery of prospects on Quartz Creek and the Tiekell resulted in the development of a trail from the point known as "The Rapids" on the Klutena River to the foot of Tonsena Lake by way of Grayling Creek, and from there up Quartz Creek over what is known as "The Drop" to the Tiekell, about 4 miles above the mouth of Bowlder Creek. The new route avoids this divide and reaches the Tonsena Valley 12 to 15 miles below Tonsena Lake by way of the pass at the head of the Kanata. From here an old Indian trail leads in a general way along the northern side of Tonsena River, reaching the Copper about 8 miles above the mouth of the Tonsena. This trail was carefully marked and can be easily followed. It will undoubtedly prove a part of the future route from Valdez to the Chettyna River. From the point where this trail reaches the edge of Copper River gorge a connection was made with an old Indian trail, leading down the westerly side of the Copper to the mouth of the Tonsena on level ground along the top of the bluffs.

The trail from Copper Center down Copper River along the westerly bank is very difficult to follow, and leading up and down the bluff it is most difficult to travel.

A trail is reported along the easterly side of Copper River, but no such trail was found. A trail along the easterly side of Copper River exists for the greater part of the distance between the mouth of the Tonsena and the Chettyna. This is very good in places, particularly near the Indian houses, and in others it is at times almost impassable.

From Indian Bellum's house, about 6 miles below the mouth of the Tonsena River on the easterly side of the Copper, a good trail leads in a direct line to the point where the Kotsena River emerges from the mountains, and from here follows the northerly side of the river for a distance of about 10 miles.

From a point opposite Bellum's a trail leads in a westerly direction across the mountains to the Kanata. This, however, is a mountainous route and, while shorter, it is more difficult than the one by way of Tonsena River.

The general route up the Chettyna River is the Nicolai trail, leading from Taral over the mountains on the southerly side of the river, to the Nicolai house on the Nezena. This is the trail followed by Lieutenant Allen in 1885. An old Indian trail was found on the northerly side of the river, leaving the bank about 8 miles above its mouth and running from here to the point where the Kuskulana River emerges from the mountains. Then, following the Kuskulana, it crosses it near the foot of the glacier and leads in an easterly direction to the bend in the Lachena. Over this route we made several trips with horses. It is well marked up and can be traveled at almost any time of the year. From the Lachena eastward to the Nezena we cut a trail over which we succeeded in taking our pack train; but it is probable that, with a little more work, a better trail could be made down the Lachena for a distance of 5 or 6 miles and then along the southerly side of the mountains to the west of the foot of Root's Glacier. From there the route we followed is probably the best that can be found to the Upper Nezena during high water. It, however, involves very rough traveling. During low water, when the Nezena can be crossed, a better route would lead along the southerly side of the mountains to the west of it.

It was reported that the Indians formerly reached the coast at a point between Yakutat and Kyak by traveling up the southern branch of the Chettyna, known by the natives as the Tana. This route involves crossing a great glacier and is no longer used by the natives.

The trail to the White River used by the natives and followed by Lieutenant Schwatka and Dr. Hayes, known as the Scholai Pass, leaves the Nezena at a point some distance above the foot of the Nezena Glacier, where a valley free from glaciation enters from the east. From the head of this a low gap leads to the head waters of White River over the foot of what has been called Russell Glacier, which the natives claim to cross in half a day. In the winter time the natives travel down the Scholai Creek, but in the summer time they use the trail through the mountains leading from the head of this to the Chettystone, an eastern branch of the Nezena, by way of which they reach the Nicolai house. This route is probably the only one feasible for crossing the Chettyna to the White or to the Tanana. It is said to be not very difficult for traveling, but I think it is impossible as a route trail along its westerly bank for a distance of some 70 miles. The trail to the Mentasta Pass along the Slahna River is now so well marked that it can be followed without difficulty.

From the mouth of the Slahna a good trail leads along the easterly side of Copper River to Batzulnetas, a distance of about 10 miles, and from here a good trail leads to Lake Suslota and to the Suslota Pass. A trail from a convenient point on the Millard trail leading directly to Batzulnetas would save considerable distance over the route now existing by way of the mouth of the Slahna.

From Batzulnetas a good trail leads about 10 miles in a southeasterly direction. It there forks into three branches leading by three different passes to the Nabesna River. They are all feasible for horse trails, and each is advantageous according to the point on the Nabesna River that is to be reached. The westerly one, by way of Lake Tanada, was used by prospecting parties traveling with pack trains during the past season, and the central one was used as a sledding route during the past winter. The easterly one, however, is the most practicable and the easiest, particularly for reaching the foot of the trail leading from the Nabesna to the head of the Tanada and the White. The trail traveled by the pack train is well marked up, but the others are difficult to follow, and require the aid of guides.

The trail from the Nabesna to the Tanada leads through one of two passes. The northerly one, the most direct, and that used by the natives, is not feasible for pack horses, while the one to the south is. This is the only part of the route which offers any difficulty whatever for pack trains or railroading, but the difficulties are not such that they can not be readily overcome. From here on to the head of the White River the country is merely hilly, and offers no difficulty to the construction of either pack route or railroad.

CARTOGRAPHY.

The difficulty of transporting provisions through unknown territory and ignorance of the conditions and obstacles to be met usually demand of the explorer that he make progress the consideration of prime importance, and that he restrict cartographic and scientific work to such as can be done without interfering with progress. In traveling through an unknown wilderness with a pack train the progress of the party naturally depended on the speed I made in seeking and preparing a trail feasible for horses. In undertaking to do both the cartographic and the scientific work of the expedition, it was plain that the methods I used must give results with a minimum expenditure of time. I chose the ordinary plane-table method as particularly advantageous under these conditions. Equipped with a telescopic alidade, it was my intention to run a stadia traverse up the bars of the Chettyna, and, using this as a base, to carry the line of elevations from peak to peak by means of vertical angles. When time and conditions prevented the use of these methods a traverse line based upon distance by pacing or estimation and altitude by an aneroid barometer could be substituted therefor and used under almost any conditions.

When the work must be based upon estimation the checks and counterchecks afforded by intersections on the plane table very much improve the accuracy of such work. A valuable check for work of every kind, and an almost indispensable one for rapid work, consists in the location of points by the astronomic determination of latitude and longitude. For this purpose I proposed using a 6-inch sextant with artificial horizon and two high-grade watches, which were to be compared before and after the trip with a standard chronometer left at Valdez. Unfortunately but one watch arrived before I left, and that too late for a careful comparison with the chronometer. It was therefore necessary to abandon an effort to determine longitude and depend for a check solely upon latitude determinations. With the instruments named, an aneroid barometer, a prismatic compass, a powerful field glass, and an Eastman folding kodak completed the instrumental outfit.

Under the impression that a trail suitable for horses had been cut through from Valdez to Copper River, I attempted to run a stadia traverse line over this route. Finding that the trail needed my almost constant attention, I was obliged to abandon the stadia work and to depend for a map of the route traveled upon such plane-table stations as I could make, and upon estimation of the distance between them. I was fortunate in the selection of stations, and succeeded in making a sketch map of the route traveled containing an amount of information entirely out of proportion to the time required to make it. This sketch was sent to you from Quartz Creek. The work in the Tonsena

High water in the Chettyna prevented the running of a stadia line along the bars. I succeeded in making a fairly accurate measurement of the distance between two bluffs a little over three miles apart, and from these I attempted to make locations by which to establish a system of triangulation, but very strong local attractions so disturbed the needle of the plane-table compass that it was impossible to get satisfactory results. I combined this work with estimation and triangulation, and in this way carried the survey to the pass between the Lachena River and Root Glacier. Here time permitted the measurement of a short base and the inauguration of a new system of triangulation, which was found to check very well with the work to that point.

At about this time the rainy season set in, and the peaks were almost constantly obscured by clouds and fogs. This condition interfered so much with the work that I was unable to carry the system of triangulation here inaugurated through to the Nezena. I was able to run a stadia line from the point where we reached it opposite the upper forks to the foot of the glacier. This placed the work on the Nezena sheet on a measured base. The work thus far checked beautifully, considering the manner in which I was obliged to carry it on. It was impossible to carry the triangulation over the summit of the glacier, and from the summit to Copper Center the entire work was based upon the estimation of distance. By carefully checking this by plane-table intersections I managed to keep the scale very uniform, and by astronomic determinations of latitude it was found the scale I had adopted was a trifle large. Reducing it according to the data furnished by these determinations makes this part of the work check very fairly with that south of the glacier.

The map of the Copper River from the Slahna to Copper Center is based upon a sketch made in a boat while running down the stream and an estimation of distances from point to point made by McNeer during repeated trips back and forth while sledding goods on the ice last winter, and the reduction of this sketch to the points at the mouth of the Chestochena and at Copper Center, which were located by latitude determinations. The Chestochena was traversed from its mouth to the log cabin, a distance of about 25 miles, and this checked by latitude determinations at its mouth and at the log cabin. A sketch of the river beyond this point, based upon the recollection of McNeer, who headed the stream last year, was not transferred to the general map, because this area, I understand, was covered by Griffith, a topographer with Captain Glenn's party.

The latitude of Copper Center, determined by observations on two different days, gives results of 61° 55.2′ and 61° 55.9′, checking, therefore, within 0.7′, while the map of last year's expedition makes it about 62° 8′. The latitude of the mouth of the Chettyna was found to be 62° 30′, checking within two minutes of the latitude given by last year's expedition. For the part of the map surrounding the headquarters of the Nabesna River I am indebted to a native known as Tanana Nicholas, whose very able sketch of the area I adapted to such features as I have been able to locate.

Acting on the principle that any information is better than none at all, I attempted to locate as accurately as conditions would permit not only the route which we traveled and the features adjacent to it, but also the area on both sides of the route as far as I could see it. By making my plane-table stations as far as possible on mountain tops, I was able to cover a wide area. Under these conditions it must be understood that while the features adjacent to the route may be depended upon as accurate within the limits of the methods used, others must be generalized and inaccurate in detail, as they were more and more remote from the point of observations. This is particularly true of the area east of Mount Wrangell, at the head of the Nabesna River, which, as has been said, is based upon information gotten from the natives, and while it may be very inaccurate in detail, it represents the best information regarding this area obtainable at this time, and, I trust, will prove of value to those interested in its development.

REPORT OF JOHN F. RICE.

Sir: According to your orders I have the honor to submit herewith a report of my labors and operations in connection with the Copper River Exploring Expedition under your command.

My orders were as fellows:

> Valdez, Alaska, *June 1, 1899.*
>
> **Sir:** You will proceed to Eagle, Yukon River, via Copper River, Slahna River, Mentasa Pass, and from that point onward over such route as Post-office Inspector C. L. Wayland may elect, to Eagle.
>
> At Copper Center you will cross the Copper River, follow the Millard trail to a point beyond Bowlder Creek, where you can get down to the Copper River, up which you will travel until you are above the mouth of the Slahna, where you will ford. In the absence of Indian guides, you will follow up the left bank of the Slahna.
>
> At Copper Center you will supply your party with such stores as may be required to subsist your party to Eagle, receipting therefor to Private Hallett, Fourteenth Infantry, in charge of station.
>
> You are authorized to employ such guides as may be necessary to take your party through with the least possible delay.
>
> You will keep an accurate description of your journey, to be made out in a formal report to me on your return.
>
> On your arrival at Eagle you will report to the military commander there, whom I have requested to furnish you with supplies for your return journey to Copper Center.
>
> The quartermaster of the expedition will transfer to you, on memorandum receipt, the necessary funds to pay for services of guides.
>
> W. R. Abercrombie,
>
> *Capt. Second U. S. Infantry, Comdg. Copper River Exploring Expedition.*
>
> John F. Rice,
>
> *Quartermaster's Clerk.*

The expedition started on its mission the afternoon of June 16, 1899. Its personnel consisted of Edwin Wood, packer; Edwin Cashman, cook, and John Weiler, hunter. We took with us five pack and two saddle horses and the necessary rations for thirty-five days.

Post-office Inspector C. L. Wayland, accompanied the expedition for the purpose of establishing post-offices at the several mining camps along the line of travel.

Our course was up Lowe River to Keystone Canyon, which we reached the same day, after a journey of 16 miles. At this point we remained three days awaiting the completion of the trail which runs through the Canyon into Dutch Valley. In the matter of picturesque scenery the Keystone Canyon is one of the finest in Alaska.

We passed through the canyon and down into Dutch Valley June 19. We left Dutch Valley the following day and crossed into the Tiekell Valley; here we met several prospectors with pack trains en route to the Chettyna country. We followed Tiekell Valley in a northeasternly direction until we crossed the South Fork of the Tiekell River and thence followed up the North Fork of the Tiekell until we reached Stewart Creek, a small stream flowing into the Tiekell. The scenery of the valley as viewed from the divide is impressive. The moss-covered mountains tower hundreds of feet above you on either side, while the perspective, looking through the valley, is enchanting. We crossed Stewart Creek near its mouth. After several miles of travel we passed what was known at one time as Tiekell City, it having been destroyed by fire some few days before our arrival. Here we crossed another divide without much difficulty, and proceeded to the headwaters of Quartz Creek, which we followed down until we reached Belcaro, situated at the junction of Bear Creek. At the last-named place we found about fifty miners, who were long on prospects and short on gold. From what could be learned, the only way mining could be made to pay at this point was by the use of hydraulic machinery.

Leaving Quartz Creek we crossed another divide, which led the expedition to Tonsena Lake. This lake is a magnificent body of water, mainly fed by glacier streams and the melting snow from the mountains. It is about 8 miles in length and about 2½ miles in width. Salmon, pickerel, bass, and perch abound in these waters, and a variety of small and large game may be found throughout the surrounding mountains. The timber through which we passed up to this time was exceptionably heavy, and the grazing fairly good.

The Tonsena River finds its source in the lake of that name, and empties into the Copper. I employed a prospector who was camped river, while the men and impedimenta were ferried across by Garrett. We were now practically across the coast range, which in the past had been looked upon as an almost insuperable obstacle by previous explorers. Our course henceforth was along the Klutena River until we reached Copper Center, which is situated some 25 miles from Rapids City. Copper Center is located at the confluence of the Klutena and Copper rivers. The town at one time contained about 600 inhabitants. It became depopulated from natural causes, and only a few prospectors remain.

Privates Hallett and Hendricks were found stationed here in charge of military stores. It was now fourteen days since our departure from Valdez, and we had traveled about 110 miles. While here I concluded to replenish our stores, as we were running short on several articles.

A camp of about thirty Indians was found at Copper Center. They had located at this point in order to catch their winter's supply of fish, and had evidently met with good luck, for on the banks of the river we found several hundred pounds of freshly caught salmon. I employed two of the Indians as guides to place us safely on what is known as the Millard trail. We proceeded on our journey July 1, after crossing the Copper River. This stream has always been considered a dangerous one to cross, owing to its many rapids and the swiftness of its current. However, we met with no accidents. The trail, being plainly marked, was not difficult to follow. It was followed to the Sanford River. The country passed through has the appearance of an excellent one for agricultural purposes. The terraine is rolling, and free of brush and trees.

The Sanford, at the time we forded it, was exceptionally low. It has its source in the glaciers of Mounts Sanford and Drum. At certain periods of the year it is swollen to such a size as to make it an exceedingly dangerous stream to cross. After crossing the Sanford we lost all trace of the trail. Our course thenceforward was along the foothills of Mounts Sanford and Drum until we could see in the distance the mouth of the Slahna. Here we left the foothills, passed through the valley, and recrossed the Copper. It being very low it was forded without trouble. We then proceeded in the direction of the Slahna, arriving at about 8 miles above its mouth July 8. Here we were compelled to build a raft in order to get the men and outfit across. Our course was now up the west bank of the Slahna. The timber along the bank of the Slahna is exceptionally heavy, consisting chiefly of spruce, birch, and cottonwood. We traveled along the ridge until we could see Lake Mentasta in the distance.

After recrossing the Slahna and following an old Indian trail we arrived at Mentasta Creek. Here we found several deserted Indian shacks, as well as paraphernalia for catching salmon. Fording this creek we continued along the trail until we reached Mentasta Lake, which is located at the foot of Mentasta Pass. It is a pretty body of water, and the scenery about it is rugged and impressive. Above its waters tower the mighty spurs of the Alaskan range. The fishing and hunting in this region is not surpassed in any other portion of Alaska. At this place we found camped some twenty prospectors and three of the Tetling Indians. From these latter we learned that all but two of the Mentasta Indians had died the previous winter and that the two survivors had joined the Ketchumstock tribe. They were here to verify the report and, if true, to ascertain what the prospects were to obtain a winter's supply of fish. I noticed that they were heavily armed, and on making inquiry learned they had no right in this section of the country and were prepared to defend themselves if necessary. The prospectors showed me some very fine specimens of rock, which they expected to send to the States to have assayed. We left the lake July 12 and proceeded through Mentasta Pass. This pass is extremely low and narrow, and in passing through we could scarcely realize, but for the mountains towering above us, that we were traveling through the Alaskan range. Once through this pass we soon reached the Little Tok, which was easily forded, and proceeded to the Big Tok. Arriving there we were again compelled to build a raft to get our outfit across. In the valleys between these two rivers we encountered some of the heaviest timber we had yet seen on our travels. Some of the spruce and fir trees were over 2 feet in diameter and 90 to 100 feet in height.

The guide we employed at Mentasta Lake was dismissed after he had put us on the trail which leads to the Tanana River.

The Tanana was reached July 16, after traveling over some 25 miles of the levelest as well as the dryest country in Alaska. Fortunately the railroad (which was expected to run through that section) would be completed. The Ketchumstock Indian is superior intellectually, physically, and morally to the Copper River Indian. He is very hospitable, as well as honest, and a cache left in his charge is safer than when left with some white men. He is very fond of tobacco, sugar, and tea, and prefers these commodities to money. The women and children, as well as the men, chew and smoke. Like all other Indians, they are subject to lung and other hereditary diseases, and consumption is carrying them off rapidly.

I employed one of the Indians as a guide to take us to Ketchumstock village.

Leaving the lake, we crossed a divide and descended into Mosquito Valley, through which runs the creek of that name. Mosquito Creek is a tributary of Forty-Mile River. The valley is very properly named. Millions of mosquitoes, gnats, and other pestiferous insects find a habitation here. The surface of the country is low and the growth of grass something extraordinary. The valley is about 25 miles wide and 50 miles long. It is sparsely timbered, except along the bank of the creek. Judging from the character of the soil, nearly everything grown in the States, with the exception of fruit, will grow here. As we advanced up the valley our route was along a corral some several miles in length, and constructed similar to our rail fences. Into this huge pen of thousands of acres the Indians drive the caribou and moose. Openings at intervals are left in the fence for the animals to escape. As they emerge from the pen through these openings the Indians lasso them and cut their throats. Their object in hunting in this manner is that they all can take part in it, and does not scare the game, as do firearms, besides saving ammunition, which is exceedingly scarce in that part of the country.

Ketchumstock village, the home of the Ketchumstock Indians, was reached July 21. We had now traveled a distance of about 321 miles since our departure from Valdez. When we arrived at Ketchumstock our guide refused to proceed farther with us, as the law of trespassing on the territory of other tribes is rigidly enforced, the penalty being the death of the invader if caught, unless he shows a permit from the chief of the country to travel through it. After a great deal of coaxing and promising to bring him tobacco he finally consented to accompany us to Franklin gulch.

Leaving Ketchumstock, we proceeded to Franklin gulch. Our course was over the Ketchumstock hills to the head of the gulch, and down the gulch until we reached its mouth. Strung along the gulch are the cabins of the miners, who are still searching for gold. Franklin gulch is one of the oldest mining camps in Alaska. At one time finds there were rich and numerous. But little of the precious metal is now found, as the mines have been nearly exhausted.

While at the gulch we were informed that all of the claims had been bonded to a New York syndicate and that in the near future improved processes in mining would be inaugurated. Thus far Franklin Gulch was the first locality we struck where mining was in actual progress. While there specimens of gold nuggets were shown us ranging in value from $5 to $75, all of which had from time to time been taken from the gulch. The possessors of these nuggets took great pride in exhibiting them and in relating stories of their early days in the gulch.

Our objective point was now Eagle City, on the Yukon. Upon making diligent inquiry we could find no one who could positively locate the town. As it was necessary for us to proceed on our journey, I employed a guide who pretended to know the country over which we were to travel. Some of our provisions were now growing scarce and, being unable to purchase any of the miners, we finally borrowed what we needed to carry us through, promising to return the same in kind on our way back. At the mouth of the gulch we crossed the South Fork of the Forty-Mile River, and from thence proceeded by way of the Forty-Mile trail until we reached the head of Steele Creek. Our course was now down Steele Creek to its mouth, which, when reached, we crossed Forty-Mile River proper. Once across the river we again took up the Forty-Mile trail (which runs along a ridge) and followed it until we reached the "Dome," a peak about 8,000 feet high, dome-like in shape. At this point we left the Forty-Mile trail and proceeded due north, crossing a tributary of O'Brien Creek near its source. We again reached the ridge and traveled along it for a few miles, when the waters of the mighty Yukon burst upon our vision. Continuing along the ridge, we caught sight of an island. Thinking it might be Belle Isle (the former name of Eagle), we passed down the ridge to the head waters of a stream which we supposed was American Creek. As a purpose of superseding Captain Richardson. I remained at Eagle City eleven days before commencing my return journey to Port Valdez, spending the intervening time in replenishing our supplies, resting my men and horses, and having the latter properly shod.

A few words about Eagle City may prove interesting. The town is second in importance to any on the Yukon and appears to be in a flourishing condition. It is located above the mouth of Mission Creek, sufficiently high to prevent its being damaged by the overflow of the Yukon. It has a population of about 700. Most of the dwellings are constructed of logs. The Alaska Commercial Company, the North American Transportation Company, and the Alaska Exploration Company have general supply stores at Eagle City. There is also a sawmill with a capacity of turning out several thousand feet of lumber per day. In addition to the above, the town is well supplied with retail stores, restaurants, and saloons. There was no church edifice at the time of our visit. The gospel was being expounded in a saloon. I found the town to be an exceptionally quiet one. I saw no gaming or dance halls in operation and no immoral characters parading the streets, such as are seen in most mining camps.

Previous to my return to Valdez I learned that a horse belonging to Lieutenant Lowe's expedition had survived the winter and was then at Forty-Mile Post. I went in person and brought it back to Eagle City. The horse was in exceptionally good condition and was used to good advantage during our return trip.

Having thoroughly recruited the men and horses, and being fairly well provisioned, we started on our return journey to Valdez August 9 over practically the same route that we had traveled before. Instead of returning by way of Boundary Creek, however, we followed the trail that leads up American Creek. We then took the ridge, traveling along it until we reached the "Dome." From this point onward we traversed the identical route over which we had hitherto traveled. We carefully reblazed the trail as we went along, in order that those who had passed over it after us would have no difficulty in pursuing their way.

Between the "Dome" and Forty-Mile River we encountered a pack trail from Forty-Mile Post packing provisions to Jack Wade Creek. The latter is a stream which runs into the South Fork of Forty-Mile, and whose course is paralleled to Napoleon Creek. Here we were informed that a rich strike had been made on the creek and that out of a wheelbarrow of dirt upward of $800 of gold had been panned, the gold assaying $18.40 per ounce. It was estimated at the date mentioned that there were some 700 prospectors located on the creek. In the pack train was a horse that had wintered in the vicinity of Lake Mentasta and had been picked up by a prospector and taken down to the post. This would seem to demonstrate that stock can be successfully wintered in the interior.

Captain Glenn's expedition was met midway between Steele Creek and Franklin Gulch, en route to Eagle City. At the headquarters of Mosquito Creek, between Ketchumstock and Mansfield Lake, we met Mail Contractor Holman with his pack train, establishing mail stations along the trail, as well as leaving supplies at the several stations to enable him to successfully carry on his operations the coming winter.

Between Slahna and the Sanford rivers we encountered a herd of caribou. While they were inspecting our outfit, Wood fired several shots at them, but without effect. It was near this same spot, while on our way to Eagle City, that Wood was treed by an enormous brown bear. Hearing footsteps in his rear, he turned and discovered the bear making for him at a slow pace. Wood sprinted for his life to the nearest tree and swung himself by a handy limb to a place of safety. We heard his cries for help and frightened the bear away by firing our guns. On September 2 we arrived at Copper Center. Here we met Surveyor Powell of the expedition, who was running a line from that point to Mentasta Lake. We remained here one day, recruiting men and horses. At 2 p. m., September 3, while standing on a stump making observations, I was violently precipitated to the ground by a sudden seismical disturbance. The earth seemed to rock like the angry billows of the ocean. The trees swayed to and fro as if a hurricane was raging. In the midst of the convulsion of nature there was borne to our ears far-off sounds resembling the discharge of heavy artillery. Some 15 miles distant we could see Mount Wrangell emitting smoke and lava. The scene was one of terror, as we expected every minute to see the earth open.

On September 4 we proceeded on our journey to Valdez, reaching Klutena Rapids the same day. Upon our arrival at the north fork of the Tiekell River we found Captain Abercrombie with his construc-

TRANSALASKAN ROUTE.

The all-American route is some 200 miles shorter than either the Skagway or White Pass, or Dyea or Chilkoot routes. It is the only route that can be traveled from the coast to the Yukon without being compelled to make a long and tortuous passage by boat. By taking this route no disagreeable transfers, such as are found on the other routes to the Yukon, are necessary. It will be found the cheapest and most feasible route to take stock into the region of the Yukon, being accessible to Dawson, Forty-Mile Post, Fort Cudahy, and Eagle and Circle cities, as well as to the different mining camps in the Forty-Mile country. There is an abundance of grass as well as water along the route for stock from May to October. Stock can be grazed along the way as far as Mosquito Valley, and there left to be drawn upon from time to time as occasion demands.

There is an excellent opportunity for enterprising and adventurous persons to make money by shipping stock to Valdez and then driving them through to the Yukon. Cattle could be made to sustain themselves en route, and, if carefully driven, should be in excellent condition when they arrive at their destination. The price of fresh-dressed beef in the Forty-Mile and Yukon countries ranges from $1 to $1.50 per pound. On the foot cattle sell at 23 to 50 cents per pound.

FOOD RESOURCES.

The food resources of the interior of Alaska are not as meager as may be supposed. There are to be found the caribou, moose, brown and black bear, mountain goat, and several varieties of smaller game, such as wild goose, the duck, the grouse, the fool hen, and ptarmigan. The rivers and lakes abound with choice varieties of fish, such as the king salmon, dog salmon, pickerel, perch, bass, whitefish, trout, pike, and grayling.

Of the smaller fruits there are the cranberry, salmon berry, blueberry, alder berry, raspberry, and wild currant, all of which grow in great profusion throughout the interior.

Small garden vegetables are successfully grown at Forty-Mile Post and Eagle City. At these points I saw fine specimens of potatoes, cabbage, turnips, beets, radishes, carrots, and lettuce, all of which had been grown by the residents of the towns.

TIMBER.

The country through which we traveled is fairly well timbered. As you travel northward and reach a high altitude the timber line varies. The varieties of timber are the spruce, the fir, the birch, the cottonwood, the alder, and the willow. The predominating varieties are the spruce and fir, which latter grows to an enormous size. The spruce may be used for mining and railroad timber, as it averages from 12 to 18 inches in diameter and from 75 to 85 feet in height. The white birch predominates in the vicinity of the Slahna, and will average about 14 inches in diameter. Forest fires have destroyed thousands and thousands of acres of timber throughout the interior, especially so in the last few years.

CLIMATE.

The climate in the interior of Alaska is milder and much dryer than it is on the coast. From June until September it resembles the climate of the northern portion of Minnesota and Wisconsin.

RIVERS.

The rivers along this route, with the exception of the Yukon, are exceedingly difficult to navigate, owing to the swiftness of their currents as well as their many rapids. All rivers south of the Forty-Mile River are fed by glacier streams. They are usually muddy until late in the fall, when they begin to grow clear, owing to the fact that the glaciers have then ceased their flow.

JOHN F. RICE,
Clerk, Copper River Exploring Expedition.

Capt. W. R. ABERCROMBIE,
Comdg. Copper River Exploring Expedition.

REPORT OF OSCAR ROHN ON EXPLORATION IN WRANGELE MOUNTAIN DISTRICT.

TOPOGRAPHY.

The country about Valdez consists of a series of rugged, sawtooth ranges with a general east and west axis, separated by narrow valleys. In traveling to the interior over the new route the first of these ranges is crossed through Keystone Canyon and the second by Thompsons Pass from Lowe River to the Chena River. The Chena River, rising in the range east of the Valdez Glacier, flows first in a general southerly direction for a distance of some 8 or 10 miles, and turns abruptly east into a deep, narrow, canyon-like valley, which it follows in the same general direction to the Copper River. Our route reached the Chena at the turn and followed it for a distance of from 15 to 18 miles to a point where it is joined by the Kanata. This enters by a valley transverse to those thus far crossed. The valley of the Kanata leads in a general northerly direction over a low divide into the valley of the Tonsena River, the southern border of which marks the northern limit of the Coast Ranges.

From the confluence of the Kanata and the Chena the extremely jagged nature of the ranges, characteristic of much disturbed bedded rocks, gives way to rather more regular forms which, northward, become more and more rounded in outline. This is particularly true of the moderately high range separating the valley of the Tonsena from that of the Klutena, the regular, well-rounded outlines of which indicate massive eruptives. The range between the Lowe River and the Chena River, while widening to the east, continues with the same general features between the Chena and the Tasnuna to Copper River. The area between the Chena and the Tonsena in one direction and the Kanata and the Copper in the other consists of an irregular group of rather uniformly high, close-nested peaks, attaining an elevation of perhaps 5,000 to 7,000 feet, and marked by no heavy or regular drainage lines. This area can not be very rugged or difficult of access, as it is crossed by an old Indian trail from Copper River to the valley of the Kanata.

Westward of the Kanata is a heavy range, which is separated from the range adjacent to the Valdez Glacier by the valley of the Upper Chena on the south and that of Lake Tonsena on the north. This valley is cut by a high and difficult divide, separating the two valleys named.

Northward from Tonsena River, and extending eastward to the Wrangell Mountains, is a great flat valley covered with an exceedingly heavy deposit of gravel and glacial silt, indicating, as has been suggested by Scharder and others, that it was at one time the bed of a great lake or arm of the sea. This valley extends north to the Mentasta Range, which forms the divide between the Tanana and the Copper, and westward to a low divide between the Copper and the Sushitna. Through this valley the Copper River cuts a gorge between gravel banks, at places attaining a depth of 500 feet, and lateral streams enter it through corresponding gorges. Washing out the finer material and leaving behind the heavy glacial bowlders makes the beds of these streams so full of large bowlders that they are always exceedingly dangerous, and often entirely unnavigable with boats. The bed of the Copper is in places, notably between the Gulkana and Tazlena, so full of heavy bowlders that at low water navigation by means of small boats is not lacking in excitement. These gorges add greatly not only to the difficulty of travel but to that of trail building or railroading or any other similar enterprise in this area. The Copper River follows the eastern border of the group of mountains south of the Tonsena to Woods Canyon. Just above this it is joined to the east by a river of about equal volume, known as the Chettyna. The Chettyna River follows the southern edge of a broad valley which widens rapidly toward the west.

South of this valley is a group of mountains resembling in every way the group south of the Tonsena, of which it is the eastern extension. The Chettyna River rises at a point about east from its mouth in a glacier descending from the high range forming the northern extension of the St. Elias Mountains. It is joined from the south by one important branch, called by the natives "Tana." This river tant feature is Mount Wrangell, a huge, smooth, slightly rounded dome, towering above all surrounding peaks. The surface of this is covered with a great thickness of ice, broken only by a number of small conical fumaroles. To the north and northwest of Mount Wrangell are two very prominent peaks, known as Mount Sanford and Mount Drum, and to the southeast is a peak known as Mount Blackburn. The latter presents a rounded mesa top, the remnant of a form once similiar to that of Wrangell, but now deeply indented by erosion. Mounts Sanford and Drum have suffered even more from erosion; Mount Drum, in particular, presenting from the south a jagged, crater-like appearence. This, however, instead of being an actual crater, is more probably an example of the amphitheater form of erosion due to the local glaciation. From the north the appearance of Mount Sanford and Mount Drum is almost identical. A divide connects Mount Wrangell with Mount Drum, and another connects Mount Wrangell with Mount Sanford. The basin between the two gives rise to the Sanford River. Mount Drum is an isolated mountain, bordered on its northwestern side by the great flat valley of Copper River. To the southward a series of foothills front Mount Wrangell, and these widen toward Mount Blackburn.

The southern side of Mount Drum is drained by Knetena Creek and the southern and western side of Mount Wrangell gives rise to the Chestaslena, while the area south of this and immediately west of Mount Blackburn is drained by the Kotsena. This stream, heading at Mount Blackburn and flowing in a westerly direction through a narrow, deep valley, turns abruptly at the point where it emerges from the mountain, and, following the foot of the mountains southward through a narrow canyon for some miles, again turns westward and empties into the Copper about a mile above the mouth of the Chettyna.

All of these streams are mountain torrents and unfit for canoeing. Fronting Mount Blackburn to the south and west, for a distance of 15 to 20 miles, is a group of mountains or foothills of rather uniform elevation from 5,000 to 7,000 feet. The area southward from that drained by the Kotsena River is drained by the Kuskulana. This, like the Kotsena, heads in a glacier descending directly from Mount Blackburn. It flows in a southwesterly direction, emptying into the Chettyna about 10 miles above its mouth. The divide between Mount Blackburn and Mount Wrangell is uniformly high and impassable.

In a direction a little north of east from Mount Blackburn extends a range a little lower than Blackburn itself, terminating about 20 miles to the east in a prominent peak called Mount Regal. Beyond Regal, the range is a little lower, and makes a horseshoe bend northward to another group of mountains surrounded by a prominent peak, almost in line with Mount Blackburn and Mount Regal. This I have called Mount Abercrombie. In this northward bend are two passes occupied by lobes of a great glacier, which gives rise to the Nezena on one side and the Tanana on the other. The summit of these glaciers constitute the lowest point in the range, an elevation of over 8,000 feet. Mount Abercrombie is at the northern end of the northern extension of the great St. Elias Range. The White River heads in the Russell Glacier, descending the northern side of this mountain. It is thus seemingly the highest point on the continental watershed, giving rise to the White, which flows northeast, the Tanana to the northwest, and the Chettyna toward the southwest. There is a comparatively low break between the head of White River and Scholai Creek, which leads into the Nezena. Russell Glacier, at the summit of this pass, can be crossed in half a day. The pass between the Nezena and the Tanana, which I have named Meiklejohn Pass, involves crossing a glacier 47 miles long with an 8,000-foot summit.

A high range extends a considerable distance eastward from Mount Abercrombie, and forms the southern border of the White River Basin. To the north of the high range between the Tanana and the Chettyna is a valley about 15 miles wide, extending in a northwest-southeast direction. This is bounded on the north by a group of mountains, which forms the southern extension of the Mentasta Range, forming the divide between the Copper and the Tanana rivers. Both the Tanana and the Nabesna cut this range through narrow gorges. The valley is crossed by a range of low hills, forming the divide between the Tanana and the White, and to the westward it terminates in a narrow pass leading to the valley of the Nabesna, the great western branch of the Tanana, which drains the triangular area between Mounts Wrangell, Blackburn, and Regal, the area which has generally been considered the drainage basin of the Copper River.

The valley of this stream is separated from that of the Copper River easterly slope of Mount Sanford, I was unable to determine, but it is probably the latter. The drainage basin of the head of the Copper River is, therefore, very much more limited than was formerly supposed, and the area east of Wrangell Mountains, that had formerly been considered as belonging to the Copper, in reality belongs to the Tanana.

The Nabesna Divide is cut by three easy passes, suitable alike for horse trail and railroad. The Nabesna-Tanana Divide is crossed by a pass somewhat more difficult, but the Tanana-White Divide is merely a range of hills. The area is therefore very accessible, and affords an easy route from the valley of the Copper to the valley of the Yukon. The Nutzotin Mountains, the easterly end of the Mentasta Range, are jagged mountains, characteristic of highly inclined bedded rocks. North of their intersection by the valley of the Nabesna, they become more regular. Back from the Copper River, between the Slahna and Chestochena, is a range of low, rounded hills. In the direction of the head of the Chestochena very high snow-capped peaks are seen. These, probably, are in the vicinity of Mount Kimball, in the range bordering on the Tanana Valley. In descending the Copper, after passing the Slahna River, which is a stream of considerable volume entering the Copper from the neighborhood of Mentasta Pass, the next stream of importance is the Chestochena. This is a swift stream of considerable volume, rising in the Alaskan Range in the neighborhood of Mount Kimball.

The area between the Chestochena and the Tazlena is drained by two small streams known as the Gakona and the Gulkana. From the southerly side the one important stream entering Copper River is the Sanford, which empties into the Copper about 15 miles below the Chestochena. Beginning some miles above the mouth of the Slahna to a point some miles above the mouth of the Sanford, the Copper River is very wide and spreads over what, in connection with Alaskan streams, are called snag flats. At the point named, above the Sanford, it gathers into a single channel, and does not again spread very much except for a few miles below the mouth of the Gulkana.

One of the most interesting features of the summer's work was our inability to find and locate the mountain mapped as Mount Tillman. In coming down the Copper River from the north, Mount Wrangell is visible between Mount Sanford and Mount Drum at a point opposite the mouth of Sanford River. From here Mount Drum masks Mount Wrangell, and the latter again becomes visible at a point a few miles above the mouth of the Tazlena. On the day we came down the Copper River an eruption took place which left no doubt whatever that this is Mount Wrangell. At Copper Center, Mount Drum completely masks Mount Sanford, and from this point the only mountains visible were Mount Drum, Mount Wrangell, and Mount Blackburn. In descending Copper River from Copper Center a mountain again becomes visible between Drum and Wrangell. Were it not for the fact that it is masked by Drum at Copper Center this mountain might easily be considered south of Drum and between it and Wrangell. It is highly probable that in ascending Copper River, Lieutenant Allen got only occasional glimpses of these several peaks, and that owing to an error in observing bearings, or to this deceptive position of Mount Sanford, he considered it a peak south of Mount Drum. Such an error might very readily be made. However, in view of the care with which we studied the position of these mountains in traveling from the Slahna to Tonsena Lake, and the great number of clear days which enabled us to see them from all positions, I have little hesitation in saying that there are only four mountains, and that the location of Mount Tillman on the map is an error.

MINERAL RESOURCES.

Copper.—The copper in the interior of Alaska has this year, for the first time, attracted the attention of prospectors, and, as a result of the season's work, rich finds are reported on the Chettyna and Kotsena and on the head waters of the Tanana and White rivers. How far these reports are reliable remains for future developments to show. Nicolai, the Copper River chief, who is responsible for most of the earlier reports of copper on the Chettyna, for the first time disclosed the location of the vein from which he secured the samples of ore which he displayed. This vein is located on a small creek emptying into McCarthy Creek and between it and the Nezena River. This is a true vein deposit in a fissure, probably due to faulting. The main body of the ore is bornite. It occurs in a dark-green amygdaloidal diabase near the contact of the same with a heavy limestone bed. The diabase seems to be irregularly bedded and can be traced for miles in ilar diabases at the head of the Kotsena River belong to the same series. The heavy limestone bed, however, does not appear on the Kotsena.

None of the locations made at the head of the Tanana or the White were visited, but fragments of rock, heavily copper stained and impregnated with native copper, were found in several places, particularly in the pass from the Tanana to the Nabesna rivers. Here the rock seemed to be a later volcanic, which, as in the Nicolai location, was much fractured, faulted, and associated with sedimentary rock. The Indians on the Nabesna had bullets, knives, and arrow points made of native copper. They explained that they got these at four different places, one on a tributary of the White River, probably the one which Dr. Hayes visited and which he found to be a copper placer. The others were farther west on the head waters of the Tanana and the Nabesna. Whether these were also placer deposits could not be determined. The frequent copper stains on the rocks and the many different points at which copper has been found leave little doubt that there is copper disseminated through some formation in the area, but whether this exists anywhere in workable quantities remains to be proven.

At the head of the Kotsena and in the area about Mount Wrangell diabase dikes frequently carry a very large quantity of iron sulphides, seemingly as original rock constituents, but probably as impregnations. The same impregnation of the iron sulphide was found in many of the larger masses of acid volcanics, notably the boss-like mass of granitic porphyry, south of the pass by which we left the Kuskulana River. It is not impossible that these pyrites may carry copper and in some cases silver and gold. Should they be found to do this, they will prove to be of great economic importance, as the ledges are sometimes very large. Specimens of these rocks were collected, but assays of them have not as yet been completed.

Several ledges are reported to have been located on the lower Kuskulana, where it cuts the metamorphosed sedimentaries of the lower Chettyna Valley. It is not impossible that gold may be found in the metamorphosed shales and slates of this area.

The occurrence of veinlets of cinnabar and sulphur at the head of the Kotsena River has been noted in the preceding chapter.

While workable ore deposits have not been shown to exist by actual exploitation, the information collected shows the area to be a mineralized one and one favorable to mineral concentration, an area, therefore, warranting a detailed economic survey.

Placer deposits.—The most promising discoveries of placer gold in the Copper River country to the present time are those of Quartz Creek, Fall Creek, and the Chestochena River. While some good, coarse gold has been taken out of both Quartz and Fall creeks, these areas are as yet entirely undeveloped, and it remains to be proven whether or not they will be found paying. The formation underlying these is the same and corresponds to that named by Schrader the Klutena Series, which he suggests resembles in many respects the Forty-Mile Series of the Yukon district.

The continuation of this series of rock was not traced, but it probably is not limited by the area thus far outlined.

Of the Chestochena River very little is known other than that the prospectors who returned late in the past season reported the discovery of prospects to which they intend to return in the spring. The reported discovery of platinum placers caused a rush to Mount Drum last year, and a second one at the opening of the present season. So far as known, however, no platinum has been found.

NARRATIVE AND ITINERARY.

The discovery and development of copper claims on Prince William Sound revived an interest in the numerous reports from different sources, some of which date back to Russian times, representing the country drained by the head waters of the Chettyna, Tanana, White, and Copper rivers, rich in mineral deposits and particularly those of native copper. This, together with its apparent rugged and volcanic nature, conditions not unfavorable to mineral concentration, made this area the objective point of most of the prospectors who remained in the Copper River country during the season of 1899. Beyond the information contained in the report of Lieutenant Allen, who ascended the Chettyna to the Nicolai house and the Copper to Batzulnetas, and of Lieutenant Schwatka and Dr. C. Willard Hayes, who crossed the range by the Indian portage from the White to the Chettyna rivers, nothing definite was known of the areas. Various vague and conflictcourse, the generally accepted notion that the drainage of the Copper bounded that of the Chettyna. If it were found impossible to cross the divide with the pack train, the same was to turn back and the journey be continued with the dog train, which was taken for that purpose. In addition to making a general topographic reconnaissance map of the area, I was instructed to study its geology and mineral resources as thoroughly as conditions would permit.

The party consisted of two packers, J. V. Place and Archibald Crawford, to handle the pack train, and John Fohlin to handle the team, consisting of nine dogs. The provisions selected were calculated to last four men one hundred and fifty days, and in addition to the regular camp outfit we carried two 11-foot King canvas folding canoes for crossing glacial streams too deep for the horses to ford. This precaution was deemed very important, in view of the difficulty in crossing glacial streams experienced by the Schrader party and the serious accident that befell it in attempting to cross Tonsena River on the previous year. Unfortunately, but five horses could be spared for this work, but additional horses and packers were detailed to assist in crossing the coast mountains. The necessity of waiting for the completion of the trail through the Keystone Canyon delayed our start until the 18th of June. At camp 2, at the foot of Keystone Canyon, which we left on the morning of the 19th of June, we were joined by Rice's party conveying Mail Inspector Wayland from Valdez to Eagle City, on the Yukon; the party of Mail Contractor Holman and two prospecting parties, one McCarthy's and the other Young and Downing's. From the end of the trail through Keystone Canyon we proceeded up the gravel flats of Lowe River to the Government cabin. From here we went, in one day, down to the Chena River, where we found encamped a number of prospecting parties who had come in early in the season. Among them were the parties of McClellan, Amy, Millard, and others. They joined the caravan which was following us into the interior. From here, after going down the gravel flats of the river some 3 miles, we were obliged to make a trail along the southerly bank of the stream for a distance of 8 or 10 miles. Then we crossed the stream at a point where it was spreading and shallow, and continued down its northerly bank some 3 or 4 miles farther, making our way through a gap in the range to a point on Stuart River some distance above its mouth.

Traveling was very difficult, and we were four days in making the distance from the first camp on the Chena to the mouth of Stuart River. The river breaks through five different box canyons, and the banks are everywhere rugged and precipitous. It seemed to me that the best route for a permanent trail would be to keep from the Lowe River divide along the foothills on the right, keeping down the right bank of the Chena for a distance of some 8 miles, where it flows through a narrow, rocky gorge, that a short bridge would span, and then continue down the northerly bank of the river through a gap by which we reached the Stewart River. This river, just above the point at which we crossed, flows between two projecting points, which a short bridge would span. These facts I reported to you from Quartz Creek. From Stewart River we followed the right bank of the Kanata to Bowlder Creek, where we camped. It was reported that a low divide led from the head of the Kanata to the southerly branch of the Tonsena, but we were unable to find anyone who would give us any definite information regarding this route; and whereas it probably involved much trail cutting and possibly considerably swampy ground, I preferred to go over the known route by way of Quartz Creek. Accordingly, we followed the left bank of Bowlder Creek up the mountain side to an elevation of about 2,000 feet, and then traveled along a bench above timber line to the Quartz Creek Divide. We found this divide, as we had the Low River Divide, almost free from snow, but exceedingly soft and miry. Nevertheless, we managed to make the distance from Bowlder Creek to the confluence of Bear and Quartz creeks in one day.

From here one day's trip took us to Tonsena Lake, a distance of about 7 miles. The best information I could get led me to believe that the Indian trail eastward from Tonsena Lake led to the Stickwan house on Copper River, a few miles south of Copper Center. In view of this, and the fact that the pack trail would have to make a relay trip, I decided to send it over the known trail to Copper Center with the first loads, and while it was making this trip Fohlin and I would explore the trail to Copper River. We found that this trail, after following the Tonsena River in a general way for about 25 miles, led away from the river in an easterly direction, reaching Copper River abandoned their camps and were on their way to Valdez. These men had sledded their outfits from Copper Center up the valley of the Lebigstag and over the divide separating this from the Kotsena, early in the season, in an effort to cross the range between Mount Wrangell and Mount Blackburn, and thereby reach what they supposed to be the head waters of the Copper. This they found to be impossible, and they had found no prospects whatever of placer gold on the Kotsena; so that, disappointed, they abandoned everything, and were taking with them only enough clothes and provisions to enable them to reach Valdez. I engaged one of these men to go with me to the Chettyna and from there to take a letter to you.

After spending three days at the head of the stream in mapping the surroundings and examining the rocks, I started back down the river. I left the foot of the Tonsena trail on the 1st of July and returned to that point on the 10th. The next day, with the help of some Indian guides, we cut a short trail connecting the Tonsena trail with the Schrader trail leading down the Copper along the top of the bluff, and over this we took the pack train, which arrived later in the day, to the mouth of the Tonsena River. Here we spent a day repairing the outfit and seeking the best place for crossing the horses. The river was here wide and swift and full of treacherous quicksands, and the water at this season of the year was very cold. By picking the way carefully and swimming the horses across one of several channels at a time, and giving them time to rest on the bars between, we succeeded in crossing without the loss of a single one.

From this place our goods were carried down the river in a boat which I secured from the natives, and we took the horses down the eastern bank of the river to the Chettyna, which we reached two days later. An Indian trail leads along the eastern side of the river most of this distance, and had we not improved it considerably in places it would have been impassable for the horses, and even then it would have been impossible to have taken them over it had they been loaded. I learned from the natives that an old Indian trail led up the northerly side of the Chettyna River some five or six days' travel, but none of the Indians I had met thus far knew of this trail, and it took us three days to find one who was familiar with it. He lived on the westerly side of Copper River some 4 or 5 miles above the mouth of the Chettyna. After much coaxing and many promises he finally consented to go as our guide.

On leaving Valdez we took about 200 pounds of dried fish for dog food, hoping to be able to get all we needed from the natives along the Copper and Chettyna rivers. In this I was disappointed, and, being unable to secure food for them, I had to abandon the plan of taking the dogs further. One of them had become exhausted on reaching Quartz

Creek and another had run away at Tonsena Lake. The remaining seven I sent with Rothkrantz, instructing him to take them to Copper Center and turn them over to Private Hallett, in charge of the Government station there. Extra help for cutting trail and the numerous guides we had engaged had reduced our rations somewhat, and these I replaced from the cache of McCarthy, of whom I also engaged four horses. Two of our horses were hurt and became useless. We therefore left the mouth of the Chettyna with seven horses available for carrying packs.

From McCarthy's cache on the Chettyna, about 3 miles above its mouth, which we left on Friday, July 21, we followed the banks of the Chettyna to camp 2, a distance of about 8 miles. The river bank here is very high and very rough, and the best trail we were able to make was exceedingly rough and difficult for traveling. Had it not been for the high water we could have avoided this by traveling up the bars of the river. While I was looking up the Indian guide the packers had made a relay trip with provisions to this point. We cached one-half of our outfit here, and continued with the rest, which was all our horses could carry. The old Indian trail begins at camp 2, and from here leads away from the river at nearly right angles to its course.

We found the country back from the river rolling and covered with boggy marshes and small lakes, making it necessary for the trail to meander very much at times. One day's trip took us to the banks of the Sterlina, a distance along the trail of about 12 miles, and another day took us well up into the mountains along the westerly bank of the Kuskulana. This stream which we found to be a swift, glacial stream of about the size of the Kotsena and Tonsena, was too deep to ford. We were therefore obliged to continue up its right bank to a point ment. From the camp on, the grade became easier to the divide, which we crossed without much difficulty. After crossing a small valley drained by a stream which flowed through a narrow gap in the mountains to the southward, which I called Fitch Creek, we entered a broad, open valley transverse to the drainage of the country. This was so boggy that the Indian trail led along its southern edge, and after following it for a distance of 5 or 6 miles turned abruptly across a spur of the mountains and entered a valley to the southward. From this point where the Indian trail turned off there was before us transverse to the general direction in which we had been traveling, a broad, open valley occupied by a stream which, heading in a glacier to the north, followed this valley for some miles, and at a point about opposite us turned abruptly and continued in the direction we had been traveling.

To the north of the gap through which this river flowed was another occupied by a small stream emptying into the river. Through this it seemed to me highly probable that we could make our way. The stream before us was called by the Indian the Lachena, and he told us that the trail led to his salmon cache on this stream, a short distance above the point where it enters the Chettyna. The Indian knew nothing of the valley to the northeast and could not tell me whether it would be possible to get through it with the horses.

After spending a day looking up the trail and convincing myself that it would lead too far south for our purpose we made our way over much boggy and swampy ground to the elbow in the Lachena. Since it was necessary to make a relay trip for provisions I decided to send the pack train back from here for this purpose, and before going farther with the pack train to explore ahead and determine whether it would be possible to go through the valley. The two disabled horses were now so much improved that they were able to carry light loads and, loading the necessary supplies and camp outfit on these, Fohlin and I went ahead while the pack train made the relay trip.

At the end of five days we made a trail up the valley a distance of about 15 miles, and encamped on the divide. Here I spent several days on topographic work. From one peak, which I occupied for this purpose, I saw that the valley we were in narrowed down a canyon which led out into a broad, open valley, occupied by a huge glacier, the foot of which I could not see. We were traveling along the most favorable route for the work we were doing, and I decided to continue and work our way out along the glacier, and if we could not succeed in this, to attempt to cross it. We experienced some difficulty in working down the canyon, but succeeded in making a trail over which we took the pack train later without accident.

While working our way down along the right-hand side of the glacier, which we found very slow work on account of the rough ground and heavy brush, we were overtaken by the pack train. On our return to McCarthy's cache the latter had retained the horses which I had engaged of him, so that our pack train was reduced. The packers had brought all the provisions they could to the Lachena, and there cached what they were unable to bring farther. They had left at McCarthy's one of the folding canvas boats which we had brought for crossing glacial streams and running down Copper River. We managed with much difficulty, but without any serious accident, to get our horses around the foot of the glacier. From Mount Blackburn eastward there had been no break whatever in the extremely high range along which we had traveled. A short distance ahead, however, there appeared to be two lower gaps in it, which I had hoped to reach by going up the next valley beyond the one occupied by the glacier. This valley was occupied by a small stream which empties into the glacial stream just below the foot of the glacier. Three days sufficed to take us up this stream, which I called McCarthy Creek, to its head, a distance of some 18 or 20 miles. Rainy weather had set in, and fogs and low-hanging clouds prevented me from getting a view of the surrounding country for three days. When I could see I found that the head of this valley still abutted the high ridge and that it was the second valley to the east that led to the seeming break in the ridge.

There was no way of getting through into the valley to the east from this point, and we were obliged to retrace our steps down the creek 8 or 9 miles to the mouth of Nicolai Creek, so named because it lies on a copper vein from which Chief Nicolai got the specimens which he displayed, and the location of which he refused to disclose until this year. At this point there is a break in the ridge to the east through which I hoped to be able to go. Cloudy weather again delayed us, but when it cleared I found that the next valley to the east was occupied by the Nezena, a great northern fork of the Chettyna, it to wash a perpendicular wall on the westerly side, making it impossible to come up along this side. It was therefore plain that there was no hope of getting into the valley of the Nezena except by finding a way down along the mountain side.

We brought our camp across the mountain to a point where we could reach timber line, and from here a careful search finally enabled us to find a trail, over which we succeeded (after improving it) in getting the horses into the valley. It was a most difficult trail, however, and while the horses had gotten down, it was a question whether they could ever be gotten up again. In order to cross the glacier it would be necessary to have sleds or toboggans on which to haul our outfits. I accordingly sent to the Nicolai house, which was on the opposite side of the stream, about 6 or 7 miles below, to see if it was possible to find some sleds there. We were rewarded by finding two old sleds which had been cached by prospectors who had sledded up the Chettyna to this point early in the spring. From here up the valley we were able to keep along the west side of the stream and avoid crossing any considerable channel. One day's trip took us to the foot of the glacier (128), a distance of about 12 miles, and another some 3 miles farther along the westerly side of the same.

From a prominent peak near by I saw that the first great left-hand lobe of the glacier abutted the main ridge, but that beyond this a second glacier lobe led a long ways to the westward to what seemed to be a lower divide (129, 130) than the one directly north of the head of the stream. Even if this divide were not lower than the one directly north, the approach to it was so much longer that the grade would necessarily be easier and the glacier smoother. I therefore decided to try this before attempting the one directly north, although the latter was bounded on the westerly side by a bare ridge, which seemed to offer a fair chance of reaching the summit. The foot of the glacier was exceedingly rough, but it seemed probable that after we were once well upon the glacier it would be possible to make fair headway with sleds. My plan was to have the packers assist Fohlin and me in sledding our outfit to the summit and from there have the packers return to Valdez, where Fohlin and I would attempt to make our way down the opposite side of the stream heading in the glacier, which I felt sure was Copper River. There I desired to set up the canvas canoe I had with us and construct another of canvas sacks and pack covers, and in them run down Copper River to Copper Center.

Fohlin refused to go with me over the glacier, and I succeeded in engaging a young prospector named McNeer, who, with two others, had been following us, to take his place. It was now August 26, and McNeer informed me that the previous year mush ice had begun running in the Copper River on September 25, and that after October 17 it had been absolutely impossible to get down the river. It seemed to me, therefore, that October 10 would be the latest possible time at which we could figure on reaching Copper Center by boat.

We had thus far killed several mountain sheep (**146**), and I had no reason to believe that we could not do so again on the opposite side of the range. Furthermore, it seemed to me reasonably certain that we could get some salmon of the natives. I therefore decided to take only thirty days' rations for the two of us. .This, with the necessary instruments and material for boats, together with what little camp outfit we needed, weighed 350 pounds. Not knowing how long it would take us to cross the glacier, we prepared a pot of beans and bread, mutton, and bacon enough to last us two weeks. We also took two pieces of dried spruce timber about 6 inches in diameter and 4 feet long, weighing about 20 pounds.

We started on the morning of August 26. After we had carried the outfit well out upon the glacier we loaded it upon the sleds (**143**). We had not, however, gone a quarter of a mile with these before we were hemmed in with rough ice, and at the end of several hours' hard work had to abandon the sleds and take to back packing. With about one-half of the outfit on our backs we managed to reach the foot of the ridge between the first two great lobes of the glacier. Here we found some brush and made camp. I sent the men back to the camp at the foot of the glacier with instructions to bring on three days' provisions for themselves, and bring up the sleds and the remainder of the loads the following day. I then took a little lunch and my sleeping bag and went up the glacier, to determine whether or not I would attempt to go up this lobe or the one directly north (**140**). I made a distance of about 7 or 8 miles, and after spending the night on the edge of a moraine continued 5 or 6 miles farther to a point from which I could see the summit of the glacier (**127, 128, 132, 139, 142**). It was trouble. The next day the fog was so dense and heavy that we could not move.

Place started back on the previous day to look after the horses, and Fohlin and Fitch left us about noon. I instructed Place and Fitch to return to Valdez with the pack train, and Fohlin to go to Copper Center and prepare to come up Copper River to the mouth of the Chestochena to meet us with the dog team, if we did not reach Copper Center by October 10.

On the following morning, August 30, the weather cleared somewhat, and we started out, reaching our cache without trouble. Here we camped. The next morning found a heavy north wind blowing, bringing with it frequent flurries of snow. We packed outfit to the top of the bench, and here loaded about one-half of it on the sleds and started for the summit. We traveled in a northeasterly direction diagonally across the glacier. Before we reached the foot of the last bench, a distance of about 4 miles from camp, the wind and snow had increased to a howling blizzard, and we were obliged to cache our loads and return to camp.

When morning broke September 1 the storm was still raging, and we were obliged to remain in camp. It was with great difficulty that we kept our tent from blowing away. We had no way of making a fire, so had to spend our time in our blankets to keep warm. On the morning of the 2d the weather, though still cold, had cleared, and we started out very early. At 10 o'clock we had reached the foot of the summit bench where our goods were cached. From here the best, and, in fact, the only, course seemed to be right up the middle of the glacier. On either side were tremendous cataracts, which seemed to preclude all possibility of crossing them. We had not gone a quarter of a mile from the cache, however, before the crevasses became so numerous and so large that we decided, before going farther with our loads, to explore ahead. Ordinarily crevasses are not continuous for long distances. Splinters, one end of which joins one side and the other the opposite side, cut diagonally across them. This offers an opportunity for crossing, and by working back and forth it is usually possible to make headway even over badly crevassed areas.

On this glacier, however, we found two sets of heavy crevasses at nearly right angles to each other, cutting into isolated rectangular blocks, over which it was all but impossible to make headway (131). This condition was aggravated by the loose snow of the previous day, which had everywhere built snow bridges across the crevasses, often completely masking them, so that to avoid walking deliberately into a crevasse it was impossible to take a step in any direction without first carefully feeling the way with a stick. Fastened together with a life line about our waists, one felt his way carefully ahead, while the other followed in his steps at the end of the line in order to check his fall should he break through. In this way we worked back and forth, and often, when about ready to give up and return, we would manage to find a wedge or snow bridge strong enough to bear our weight, and thus enable us to get to the next block ahead.

At 2 p. m. that afternoon, after four hours of most trying work, we had made but a quarter of a mile. We had, however, crossed the worst part, and had now reached an elevation at which the crust of the snow was beginning to be sufficiently strong to bear our weight over the crevasses. From here on the grade was slight, and we reached the summit, a distance of about 3 miles, without difficulty. From the summit we could see nothing ahead but a broad, smooth plain of snow (**127, 128**), which seemed to break down abruptly some 8 or 10 miles ahead.

I felt that life was too short to permit of taking the chances involved in attempting to bring our outfit over the route we had traveled that morning, and we decided to turn back, unless in some way we could manage to make our way over the great bench or cataract on the easterly side. This we undertook on our way back, and after many fruitless attempts we finally succeeded in making our way down. While exceedingly difficult, this route was free from the treacherous snow, and we decided to attempt to get our goods over. Our outfit weighed somewhat over 400 pounds, which was more than we could possibly handle on one trip. We concluded, therefore, to take one-half of it and on the first clear day attempt to cross the summit and reach a point on the opposite side at which we would camp, and from here return for the rest.

The next morning broke clear, and at 9 o'clock we were at the top of the bench with our loads. From here on the surface was bare and smooth, with a covering of 6 or 8 inches of snow (**133, 134**), over which surface was perfectly smooth and gave no evidence of its treacherous nature.

We were standing at this point discussing the situation and considering what next to do, when suddenly the surface of the glacier began swaying up and down in a most amazing manner. At the time I took this to be an earthquake, due to a fracture at some point in the glacier, but later I learned that it was the great earthquake which shook the entire country around. A careful survey of the situation showed us that there was only one possible way of reaching the moraine, and that was squarely down the middle of the valley before us. We accordingly fastened ourselves together with a line about our waists, tied our sleds together, and, each carrying a stick with which to span a crack and support himself in case he went through, we started out, trusting we might not meet a crevasse too wide for these means to save us if one fell through. Slipping into unexpected openings up to our knees or our waist every few paces, and not knowing at what moment a large opening would take us in bodily, traveling was uncomfortable, to say the least; but there being only one course to pursue, we pushed ahead as best we could, and at the end of two seemingly long hours we reached the moraine. Here we camped and prepared supper, after which we explored ahead and, to our great satisfaction, found that the moraine on which we were camped continued along the glacier for several miles, leaving little doubt but that over it we should be able to reach the plain below. At this time of the year days on the summit free from storm and blizzards are rare, and with the question of getting down disposed of, the next matter of importance was to get the remainder of our loads over the summit before bad weather again set in.

The next morning found us ready to leave camp at the first sign of day. The sky was overcast, but the summit was clear when we started out, and we hoped it would remain so. The necessity of picking our way carefully had obliged us on the previous day to expose our eyes frequently to the intense glare of the snow, and before night we had experienced symptoms of snow-blindness, which this morning grew rapidly worse in the cold wind which blew from the summit. While going over the divide where the traveling was good we were able to keep our eyes covered most of the time, but on working on the bench it was necessary to use both eyes and to have them uncovered. Before we reached the top of this bench with our loads on the return journey both of my eyes were all but useless and one of McNeer's was totally blind. Whether his other eye would hold out and enable us to get back to the camp was a serious question. With the prospect of wandering about on the top of the glacier in a blizzard, without food or blankets and unable to see staring us in the face, crossing crevasses caused us little concern that afternoon. In fact, by the time we got to the crevasses the pain in our eyes was such that neither of us cared seriously how soon we fell into one. McNeer's eye, although most painful, retained its sight and enabled us to reach camp, where we took to our blankets and did not again leave them until the morning of the second day. We were in an exposed position, and, the blizzard now raging threatening to blow down our tent, we managed to pack up and move the tent about a quarter of a mile into the ravine. The next day McNeer's eye was so much improved that he decided to explore ahead. He returned shortly and reported a bunch of sheep a mile or two away on the mountain side. This was welcome news, and I urged him to make every effort possible to secure one, a fact which I regretted when night came on and he had not returned to camp. When he finally did come, about an hour after dark, he reported having cached a dressed carcass about 3 miles ahead on the trail. He had become so engrossed in his sheep hunt that he had failed to notice that night was coming on, and in consequence had to take reckless chances in making his way back to camp over the glacier and moraine.

My eyes being considerably improved, the following morning we began packing our goods down the moraine, and on the afternoon of the second day after had them once more loaded on our sleds on smooth ice at the foot of the great bench. Now that the question of getting over the glacier was practically disposed of, the subject of absorbing interest was which river drainage we had reached, the Copper or Tanana. From the summit we had seen a large open valley, seemingly at the foot of the glacier and leading off toward the northwest. Now we found this valley was cut off by a range of low, moraine-like hills, which caused the glacier to turn slightly to the east, and as we traveled on down we saw more and more of a wide, open valley leading to the east. The glacier headed directly for this valley, On the day after our arrival at the foot of the glacier we climbed the mountain to the north of camp and got a view of the country farther on. To our amazement we found that the drainage of the valley toward the northwest was toward and not away from us, and that this joined the glacial stream and the drainage from the valley to the east, and broke through the mountain midway between the two valleys. We were once more in doubt regarding our position, with indications favoring Tanana drainage. Through the gap to the northwest, however, we saw a large, open valley beyond us, and this, we felt, was without a question Copper River Valley.

We had started with only thirty days provisions and were already out fifteen days. In consideration of this uncertainty regarding the route before us, I decided to send McNeer back to the glacier for another sheep. While he was thus engaged I set up our canvas canoe and reinforced it with a gunwale, preparing to transfer our goods down the stream in it. McNeer left at noon and returned next noon with a sheep. The following morning found us sick with colic, and we were unable to start; and thus we spent three days before we discovered that the cause of this was the water we were using. As soon as we stopped using the water of a clear little brook trickling down the mountain side our condition began to improve, and we were soon able to move on.

The glacial stream was at this time very low, and we were obliged to pack our goods about 3 miles to a point where a number of channels joined before we were able to use our canoe. Here we put our goods into the canoe and "lined" the same down the river. The river was so shallow and branched so frequently that our progress was but little faster than packing. In this way we reached the fork of the river three days after leaving the camp at the foot of the glacier. From here we saw that the river turned strongly east and leaves the mountain not more than 8 or 10 miles farther on. This left no doubt but that it was a branch of the Tanana.

It was now September 18. We figured that the portage to the stream in the large valley to the west could not be more than 30 miles at the most, and we calculated we could make this portage in seven days. This would give us fifteen days to make the trip down Copper River to Copper Center. It was evident that our provisions would last hardly half that length of time, but we felt sure that when we reached Copper River we would soon be able to find natives, from whom we could secure salmon; and so, with the sheep which we had on hand, we felt justified in undertaking the portage. Our outfit was too heavy to enable us to handle it in two trips, and our experience with our canoe down the river thus far showed us that it was too small to be serviceable on a large stream. The canoe was the only thing we could possibly spare from the outfit except a few minor articles. We therefore decided to abandon it here.

On account of the constant wading in the ice-cold water for the past two days McNeer was taken with cramps, so that he was unable to move one foot. Nevertheless, we started out with our packs next morning and when we laid them down that afternoon we were not less than 7 miles from camp. The next day we put the camp ahead 10 miles, and alternating in this way, the afternoon of the sixth day found us within a few miles of a wide valley seemingly occupied by a very large stream. We were now sure that we had reached the Copper at a point where it was sufficiently large to enable us to use boats or rafts and we thought we saw the end of back packing near at hand.

From this dream we were rudely awakened a little later when we noticed that the snags on the river bottom pointed in the opposite direction to that which we expected. The stream, instead of flowing to the westward, flowed east, and after seven days of hard packing we had merely reached another branch of the Tanana. The smaller channels of the river were frozen over and "mush" ice was running heavily in the main channel.

A week at hard packing had reduced our provisions about one-half. It required very little reflection to convince us that we must discontinue our search for the Copper River and that our comfort and safety required us to make our way down the Tanana to the Mentasta trail with the least possible delay, as the ice might close in any day. To Copper Center by this route was a long trip to undertake on the rations we had left, but we hoped to be able to get dried salmon and moose meat from the natives on the trip. We had carried with us, thus far, canvas sacks and two canvas pack covers, with which to make a canoe. Under the existing conditions, we could not afford the time necessary to make a canoe and, therefore, concluded we must trust to a raft.

The next day, Sunday, we returned for the last pack load of goods, him two younger men, sons of the old man. These had just returned from a hunt with the carcasses of three sheep. While we were reloading our raft and preparing to go to their camp, a sudden wind sprang up that whipped up the dust of the flood plain in a manner unlike anything I have ever seen. The sand in the air was so thick that it was impossible to see more than a few rods, and to face it was positively out of the question. We cached our goods, pulled our rafts out of the water, and hastened to shelter on the bank. We found the natives encamped on the lee side of a high bluff that offered good protection from the storm, and we camped with them. They were exceedingly hospitable and when we told them we were short of provisions, they prepared for us all the mutton we could eat. They confirmed our impression that the river we were on was the Nabesna, the western branch of the Tanana, and we learned that a good trail leads from this point to Balzulnetas on Copper River. They said they had made the distance in three days' travel without packs and in six days with moderate packs.

We endeavored to engage these men as guides and packers, but this was their sheep-hunting season, and they refused to go. After spending the night and most of the next day with them, coaxing and making all sorts of promises, they finally consented to go with us. When we were ready to start we found that their camp outfit and provisions they were taking gave them about all the load they could carry. We went through our outfit again and threw out everything that we could possibly leave behind. When this was done, and we had lightened the burdens about 10 or 15 pounds, we gave them all they would consent to carry and took the remainder ourselves. Our loads were very heavy and our progress necessarily slow. The natives saw that we were too heavily laden, and decided to leave behind the greater part of the provisions they were carrying and take part of our load instead. They began begging to be allowed to turn back, and, finding that I could do nothing else with them, I promised to allow them to do so if they would take us to a point at which they could indicate to us the trail ahead, so that we could find it without their help.

We entered a draw almost exactly opposite the one through which we had reached the river basin, and, after making about 8 miles, went into camp. The next morning it was raining and the natives were unusually hard to start. By coaxing, promising, and threatening we finally got them started, and made about 6 miles to the bank of the lake. It was now so cold that the lake was frozen over, and there were several inches of snow on the ground. Camping was uncomfortable and the natives spent a sleepless night, in consequence of which they positively refused to go farther. A repetition of the former tactics finally started them on this, as on each succeeding morning, and we reached the Batzulnetas on the afternoon of the sixth day. Here we found several large salmon caches belonging to our guides and another belonging to Suslota John, an unusually large native, who, with his family, was camping here at this time.

We had been informed by our guides that we could raft from Batzulneta, but we found the river so low that this was impossible, and, as a consequence, we were obliged to pack to the mouth of the Slahna. A native, known as Sanford Nicolai, who was coming down the river in a skin canoe from his autumn hunt, was reported to be due next day. We awaited his arrival and arranged with him to take as much of our outfit as we were unable to pack at one load to the mouth of the Slahna for us. Packing to the Slahna, we built a raft, and when Nicolai came along we followed him down the river. When we had gone about 3 miles our guide pointed out a large batteau on the bank, and we pulled up at once, especially so as our raft had proven exceedingly unsteady and too small for its load. The batteau was seemingly in good condition and we prepared to launch it. The native objected, claiming that it belonged to him and another native living some distance down the river. By promising to pay him for it we gained his consent to use it. It was a very large and heavy boat and had about 6 inches of ice in it. Nevertheless, we managed to get it into the water, and, after making a few miles more, we went into camp with the native.

The next morning we started out in good season and the following night we were in camp at the mouth of the Chestochena. This river had been attracting considerable attention, and I wished to explore it. McNeer had left the cache in a log house (148) about 25 miles up this stream, and to this we decided to go, and, if the provisions were undisturbed, to take what we needed and make a side trip up the stream. If, for some reason, the food was gone, we would return and continue of these two men we managed to run (136) to Copper Center without a mishap of any kind, and, contrary to our expectation, we reached Copper Center that night.

I expected to find here either the dog team or some pack horses with which to make our way to Valdez. Not finding either we waited for Holman, the mail contractor, who was due for six days, expecting to get instructions for our further movements. Holman arrived at the appointed time but without instructions for us. He had with him a considerable pack train, and intended to send two pack horses back to Valdez. I made arrangements with him whereby, in consideration of my indicating to his men a trail from Copper Center to Tonsena River, he agreed to carry a part of my outfit to Valdez. I therefore cached at this point everything except essentials, such as instruments, notes, and bedding.

The route proposed was a desirable one for my return to Valdez, as it enabled me to do topographical work, besides giving me an opportunity to look up a route which I considered favorable for a permanent trail. With three men and two horses I left Copper Center on October 18. We crossed the Klutena at Copper Center and, following what is known as Cooper's trail, reached Cooper's camp that night. The distance from Copper Center by trail is probably about 10 miles.

The next morning we continued in a direction calculated to take us along the eastern edge of the mountain. Timber was close and after a hard day's work we had made not more than 8 miles. We had, however, reached the foot of a lake several miles long and had moved well around the end of the mountain range. A due south course on the next day took us over fine, flat country to Tonsena River. This we reached by working down the valley of its northward branch on a gradual slope through a long draw and then following the valley down for a distance of about 1 mile to the valley of the main river. We camped on the Tonsena and continued the next day on our way. The lakes were now frozen so that we traveled on them in perfect safety. The Tonsena River was partly frozen, and we experienced considerable difficulty in getting the horses across it.

It was my impression that the branch of the Tonsena leading to the headwaters of the Kanata was the one immediately opposite the one by which we had entered its bottom. Johnson, one of Holman's men, with me, has been through this pass and consequently was supposed to know; so I accepted his corroboration of my impression. After working our way out of this valley by gradual slope to the westward, we traveled along the top of the bluff, when night overtook us after having not made over 6 miles. The next day Johnson failed to find landmarks and I began to doubt whether this was the proper creek, and before we camped that night he also was convinced of this. There seemed to be a pass to the southwest, and we decided to attempt to go through this in preference to turning back and going to the other creek.

We had attained a considerable elevation, and it was bitter cold for we were camping without a tent or other protection than a brush shed. The snow was about 20 inches deep, and it was not without considerable difficulty that we succeeded in making our way to the summit. On reaching this we found ourselves at the edge of a considerable valley, extending indefinitely in both directions. It took us some time to realize that this was the divide between the Kanata and the south fork of the Tonsena. We were fully 2,000 feet above it, and when we finally reached the valley we found a newly cut trail which we knew to be that of Lieutenant Babcock's party. Following this we reached Fall Creek that night and the government stable the next night, and from there the next two days' travel over the new Government trail took us back to Valdez.

REPORT OF ADDISON M. POWELL, GUIDE WITH COPPER RIVER EXPLORING EXPEDITION.

DEAR SIR: After guiding the trail cutters through the roughest part of the Coast Range to where station No. 3 was established, I received instructions from you to further explore the Gakona and Chestochena rivers for the purpose of determining the practicability of securing a shorter route to Lake Mentasta than that by way of the mouth of the Slahna. Pursuant to these instructions, I left station No. 3 on Monday, August 21, 1899, taking with me two horses. On the first day out one of the horses rolled about one hundred feet down an embankment and fell into deep water. I succeeded in getting him out, however, without much difficulty, and found him to be comparatively uninjured.

On the evening of August 22 I reached Quartz Creek Divide. Here I met F. J. Date, of Elkhart, Ind. He claimed to be familiar with some of the country I was to explore, and as he seemed to be good at roughing it I employed him to accompany me as an axman.

On the 24th of August I crossed the Quartz Creek Divide. On the summit we encountered a severe hailstorm. That night we stopped at the Quartz Creek mining camp. But few men were mining here, and although they had $500 or $600 worth of coarse gold dust, they claimed it was not a shoveling proposition, because of the numerous large bowlders encountered.

On the 25th of August we swam our horses across the outlet of the Tonsena or Archer Lake, reaching Twin Lakes, on Grayling Creek Divide, about midnight.

There being good horse feed at Twin Lakes, I rested the stock and remained there until the next day. There also appeared to be good trout fishing at this spot, and I caught several grayling with a fly hook. With my solar transit I took the sun's altitude, and found that we were 61° 45′ north. Here we came across the grave of a prospector who had died on his way to Quartz Creek during the rush to that place last winter.

On August 27 we camped on Grayling Creek. Near by we found the grave of a disappointed prospector, who had killed himself during a spell of despondency.

On August 29 we swam the horses across the Klutena River. At this place was stationed James Garrett, of the Fourteenth United States Infantry.

On August 31 I reached Copper Center, at the mouth of the Klutena River. This town was composed of log cabins built by prospectors. While here I succeeded in getting some old rusty bacon, some musty flour, and salt. I counted on getting supplies here, but, owing to the scarcity of edibles, was disappointed. It was evident that I would have to depend some on the game I might chance to kill with my revolver during the trip.

At Copper Center I met Messrs. Rice, Wood, and others returning from Forty Mile.

We felt a heavy earthquake shock on Sunday, September 3, at 3 p. m. After realizing that it was an earthquake I looked in the direction of Mount Wrangell, which had not been smoking much for several days. At this time it was smoking very heavily and had just discharged a large amount of lava, which descended the northwestern slope for several miles, appearing to have melted deep gorges in the snow and ice. The next day the wind drifted the snow over the blackened area. Mount Wrangell continued to smoke with unusual animation for the rest of the season.

Monday, September 4, was spent in rafting and swimming the horses across the Tazlena River. Here we met about a dozen Indians and camped with them that night. We found them to be a jovial and sociable lot. They claimed they were Gulkana Indians and lived near the Gulkana Lake; that they were on their way to Copper Center to trade skins for muck-amuck. They expressed some fear that with too many white men in the country starvation would come to them. They said that nearly three years previous the majority of their number on the Gulkana Lake had starved to death during the winter. I explained to them that as there were no white men in their country at that time they could not have been the cause of the calamity. I also told them west for the purpose of examining the foundation for a trail between the Gakona and the Chestochena rivers. After traveling over prairie ground and winding between lakes for about 12 miles I camped in sight of the Gakona River.

Our course for the next five days was generally between north and 20° east of north. The higher the ground and the farther away the Copper, the more were the lakes and swamps encountered. It seemed impossible to travel more than 8 miles a day. We crossed miles and miles of tussocks, large and shaky. Our horses became experts in stepping from one to another, a failure to land on them causing them to flounder in the mire between. We followed an old Indian trail, passing an abandoned village, where signs were written with charcoal on a cache-post indicating that two men, two women, and three children had gone up the river, passed through some timber, crossed the Gakona, and were hunting in the hills. The men were pictured as having guns. These Indians have a systematic sign language, easily decipherable.

On September 13 we camped on the foothills of the divide between the Copper and the Shushitna. Here we found fine feed for the horses and frightened a moose, which ran out of the divide.

We changed our course to 30° east and spent two days in reaching the headwaters of the Chestochena River. We traveled over high rolling ground. In some places where the ground was nearly level we found it so soft that it was with great difficulty that we could travel 8 miles a day. At one time all our horses became mired and we were obliged to unpack and assist them to walk for hundreds of yards.

Just before we reached the Chestochena we came across mule tracks, supposed to have been made by the exploring expedition under Captain Glenn.

We camped for two days on the Chestochena, about 8 miles from the glacier. During this time it snowed about 5 inches. This glacier is a large one, and from it flow two branches of the Chestochena, as well as the east fork of the Gakona. I was informed by an Indian, known as Gakona Charley, that the north fork of the Toke also has its source from this glacier at a point where it extends to the north side of the mountain.

On Saturday, the 16th, we moved camp about 2 miles above Chesna Creek, which flows into the Chestochena at a point about 8 or 9 miles from the source of the west fork of the Chestochena. Here were located a number of mining camps. A Mr. Dempsey had discovered placer gold here, and he, together with Messrs. Hazlett and Meals, had located a few claims just below the rim rock of the canyon. Five Swedish citizens from Mentasta Lake, hearing of the find, hurried to the place and located all the creek. I washed out ten pans of dirt here that averaged 6 cents to the pan. Gold was found only in the strata of clay, and as but about half of the ground was composed of clay I suppose the true average was about 3 cents to the pan. I prospected to a depth of 5 feet and did not go to bed rock. I believe this claim, being favorably situated, will pay; but as it costs about $1 per pound to get provisions into the place, it would necessarily have to be very rich. It will take the work of another summer to determine the extent of pay dirt and its value. The gold appeared to have been of a leafy character, very dark in color.

I explored to the head waters of this canyon to see if it was possible to find a pass leading to the head waters of the Tok, but found it encompassed with high, ragged mountains. From the top of these mountains a level pass was plainly seen, leading from the middle fork of the Chestochena to near the head waters of the Slahna. I easily recognized a place on the east side of the Slahna where I had been during the summer of 1898. This pass leads to another pass that would reach the Tok from the Slahna, about 10 miles north of Mentasta Pass.

As it had been almost continually snowing and blowing from the northeast, and as our horses were very weak, I decided to start for Valdez on September 29.

The mouth of Chesna Creek, as near as I can determine, is in latitude 63° 4′ north and longitude 145° 20′ west. The Chestochena River descends from N. 15° W. from its source, from which direction we follow it about 9 miles from the Chesna, where the middle fork of the Chestochena comes in from N. 20° E. One mile below this fork we find the river bears S. 25° E., which course we follow for 13 miles to where the east fork comes in from N. 20° E. The course of the river from this point is S. 30° W. for 4 miles, where it turns to S. 10° W. for 4 miles, then S. 14° E. for 4 miles, where it empties grouse or squirrel, killed with my revolver. Here I saw tracks of snowshoe rabbits, but found no rabbits.

On October 4 we traveled for about 10 miles and camped on Tana Creek, which runs S. 35° W. The prairies here were covered with good feed for the horses. In 1898 they were burned by you with a view of improving the quality of the feed, and in my opinion the feed was much better on the burned portion of the prairie. At the mouth of the Tana Creek, where it empties into the Copper, I recognized the old burying ground of 1898. The little flags, mostly handkerchiefs tied to sticks, were still fluttering in the breeze. There were three new graves. Kulkena John informed me that all the male members of the family who once lived there had died during the last winter and that the three women were being cared for by the Gakona Indians.

On the night of October 6 we were camped about 3 miles below the mouth of the Kulkena River. While there two Indians came into camp, the first we had seen on our return trip, as the Indians had not returned from their fall hunting trip. We told them we had nothing to eat, having fed all our flour to our horses. They cheerfully divided their dried salmon with us. They dry their salmon without salt, and the half-rotted stuff is very repulsive to a white man unless he is in an almost starving condition. We were very glad, however, to get the salmon, and I must say we relished them.

On October 9 we managed to reach Copper Center, having eaten but two pheasants since our meal with the Indians. At Copper Center, where there were a thousand or more men the year before, we found one man running a trading post. Here we obtained some provisions and flour for our horses. We kept moving every day, as we were afraid of winter closing in on us while on the Coast Range.

The night we were in Copper Center the thermometer registered 15° below zero. It was a battle with the elements from here to Valdez. We found the snow about a foot deep on Grayling Creek Divide, and as the wind was blowing hard we were content to crawl into our sleeping bags without supper.

On October 14 we attempted to cross Quartz Creek Divide, but were compelled to camp within a mile of the summit, in 3 feet of snow. Here we again fed the last of our flour to the horses. The snow was so deeply drifted and stiff that the next day's work was severe. We had neither supper nor breakfast, and all three of our horses were down before we had gone 100 yards from where we had spent the night. One horse gave out and I could not get him to make another effort, and as he could not live I shot him. We succeeded in making the divide about noon. It was but 3 miles down to the Government trail, and good traveling. The trail here does not cross the Quartz Creek Divide. We had part of a salmon on which to exist until we reached station No. 3, on October 17. One of our horses became exhausted, and on the 18th I took him some flour from station No. 3 and led him into camp.

On October 19 I crossed over Lowe River Divide, but the horse gave out near the summit and I was compelled to leave him. We succeeded in getting one horse over, blanketed and fed him some flour, and again crawled into our sleeping bags supperless. The next morning Date took the horse down about 2 miles along the trail to a place where he could build a fire and make some coffee, while I went over the summit to see if it was possible to save the other horse. Twice the wind blew me off the summit, but when the wind eased for a minute I succeeded in walking over with little effort. I found the horse dead, covered with the drifted snow. It seemed to be an unusually windy day. Returning, I found Mr. Date in a sheltered place near the foot of the mountain, where we enjoyed some coffee. Here the snow was blown off the ground. Our horse found a good feed of oats, left by some previous party.

On Saturday evening we reached station No. 2, where we were well cared for. We reached Valdez on October 22, in an almost exhausted condition. I am satisfied that but for the trail built by you through these mountains I would have perished by the wayside. No more laudable undertaking for the benefit of Alaska could be conceived than the development of its apparently unlimited resources, the opening up of an unknown and unexplored region, and making possible what was heretofore considered impossible by the prospector—by building the trail from Port Valdez to the Yukon.

I beg to suggest that the general course of the trail from where it nows ends should be about N. 20° E. var. N. 28° 30′ E. until the Chestochena River is crossed. This will carry it along the west side of the Copper River, dry footing, with the intention of crossing the Klu-

and with this range, but of low grade. They carry little gold, iron, and considerable lead and silver, with sulphides of copper. I also found some spectacular iron and some placer gold.

I have great confidence in the future developments of the mineral resources of this region when made accessible by a public highway.

THE COPPER RIVER VALLEY.

This valley has the appearance of once having been a vast inland sea. It has a gravel bottom to an unknown depth and is generally undulating and covered with a heavy growth of spruce. Its climate is pleasant and dry in summer, cold and dry in winter. Summer and winter in this region come very suddenly. According to a weather record kept by H. M. Stewart, formerly of Rochester, N. Y., the temperature varied at Copper Center in the spring of 1899 from 30 below to 20° above zero in twenty-four hours. This change was substantial; birds began to arrive and sing; flowers to bloom, and there was no frost. In parts of the valley where the soil is sufficiently dry and where the moss and timber has been burned is found a very heavy growth of nutritious bunch grass. Owing to this and the climatic conditions of the valley, I believe that wheat could be successfully raised. The dry atmosphere, the long, warm days of summer, the light snow fall in winter are in direct contrast to the damp summers and heavy winter snows of the coast. It is evident that the Copper River Valley is at least 25° warmer in winter than the valley of the Yukon.

Birds found in the Copper River Valley.—Widgeon, summer, mallard, green and blue winged teal ducks; black duck (very large, with blue, flat bill); grebe; loon; black or jack snipe; field or highland plover; grouse or spruce hen, which are smaller than the Pacific coast grouse of lower latitudes, have no feathers on their feet, and remain in the trees as long as the snow is on the ground. They are not hooters.

Insects found in the Copper River Valley.—Beetles: A variety of small beetles are found. Ants: Small red and black ants are found in dry, sandy ground. Bees: There is a small bumblebee, which acts and looks very much like a honeybee; in fact, it would be common to mistake it for a honeybee, as has been done by other explorers. I myself have not seen a honeybee in Copper River Valley. These little bumblebees live in the high, dry banks of streams. Our horses were frequently attacked by them while traveling along the high banks of the Copper.

Mammals found in the Copper River Valley.—Moose: Very scarce and wild. Caribou: To be found in small droves or families in the foothills; not very plentiful. Mountain sheep or bighorn: Quite plentiful in the old Alaskan Range. Mountain goat: Found near the tops of the Coast Mountains. Silver-tipped grizzly: Found in the valleys and mountains of the interior. White spot on throat; tip ends of hairs white; inner coat black. They are very ferocious and give chase to man in defense of their young.

SCENERY.

No route exists that equals the grandeur and beauty of the scenery found on the trail from Valdez through the valley of the Copper to the Tanana River, Alaska. It is a treat to the lover of natural scenery to hie himself away to the pleasant recesses of these Coast Mountains on a warm summer day and drink nectar "fit for the gods" from the cool streams. He can almost persuade himself that little gnomes have deposited diamonds therein to enhance the beauties thereof. Precipices—perpendicular walls reaching to astonishing and dizzy heights, where the eaglet is taught his first lesson—loom up before you. We find ourselves vainly endeavoring to comprehend the immensity of these grand and sublime surroundings, trying to realize that the vast waterfalls pouring over the bluffs with continuous roar are fed by melting snows and glaciers far above and miles away. Truly this Coast Range is one vast collection of waterfalls. They roar you to sleep, rumble in your ears until you awake to feast your eyes on their spreading spray and, speechless with admiration, you stand and gaze at the beautiful and variegated colors of their rainbows.

ADDISON M. POWELL.

Capt. W. R. ABERCROMBIE,
Second United States Infantry,
Commanding Copper River Exploring Expedition.

REPORT OF MR. EDWARD GILLETTE, ENGINEER OF COPPER RIVER EXPLORING EXPEDITION.

The southern coast of Alaska affords very few good harbors. This appears to be greatly due to the fact that all streams emptying into the ocean carry vast quantities of silt and earthy matter, which, quickly depositing as the ocean is reached, forms numerous deltas and fills up the neighboring coast line to such an extent that sufficient depth of water for ordinary vessels, especially at low water, is seldom obtained. From the shore back into the interior the coast range presents few practicable routes. Nearly all the canyons and drainages along these mountains are filled with ice and where the natural routes into the interior, as a rule, would be found, an absolutely prohibitory condition for travel exists. The stupendous masses of mountains and ice-filled canyons and valleys back of the green wooded islands along the seacoast, while forming probably the grandest scenery on this continent, gives no encouragement to the explorer or engineer in search of a practicable route for a railroad into the interior of the country, combined with that of starting from a good harbor.

GENERAL DESCRIPTION OF ROUTES FROM SEATTLE, WASH., TO SKAGWAY AND VALDEZ, ALASKA.

The route from Seattle to Skagway, commonly called the inside passage, is well known from the fact that most of the Alaskan and Klondike trade has been conducted this way. Until recently it was thought that the future development of central Alaska would be governed by this route, which passes through some 400 miles of foreign country, and, therefore, subject to government over which the United States has no control. The discoveries made recently at Valdez, Alaska, of an excellent harbor, and the practicability of a good railroad line from this point to the Yukon River and the gold country of the Northwest, makes the comparison of the routes involved one of great commercial interest. The chief objections to the inside passage are its impracticability for sailing vessels (the cheapest method of freight transportation), the dangers to navigation of the tortuous narrows and delays caused by being obliged to wait at certain places for a favorable time of tide in order to make the passage. A high rate of insurance is maintained on vessels and cargoes taking this route. Its value in the future will probably be mainly that for local freight and tourists' travel. The prevalence of dense fogs along this coast makes the narrow and crooked channels especially dangerous for navigation. The chief guide for the pilots is the echoes from the neighboring hills when the whistle is sounded. In Seymour Narrows, on the east side of Vancouver Island, the velocity of the current reaches as high a rate as 30 miles per hour in the spring tide, while at all seasons steamers wait for a favorable time in the tides to make the passage. The swift current in the narrows is caused by the flow of the tides in the Gulf of Georgia on the south and Queen Charlotte Sound on the north, being suddenly forced into the very narrow passage connecting the two large bodies of water. The outside or open-sea route to Valdez Bay is entirely different. After passing through Puget Sound to the ocean a direct course is laid for Meiklejohn Straits, the entrance to Prince William Sound, at the head of which Valdez is located. Maximum speed can be maintained at all times by this route and freight carried to Alaska at the minimum price, which will exercise the greatest influence on the future welfare and development of the country. The distance from Seattle to Skagway is 1,050 miles; from Seattle to Valdez, 1,250 miles. This difference is practically offset by the unimpeded passage of the outside route. Valdez being 415 miles west and 120 miles north of Skagway, this port is that much nearer central Alaska than Skagway and 200 miles nearer by railroad to what is known as the Forty Mile country. The ruling question, however, being cheap freights, the element of fast time is not so important a matter as that of furnishing supplies to miners and prospectors at the lowest prices possible. Insurance rates afford a fair index of the comparative safety of the two routes, those on the inside passage being double that of the outside passage.

VALDEZ BAY.

Valdez Bay (**85**), situated at the head of Prince William Sound, in [redacted] hastily built there is danger at any time of having the buildings swept into the bay by the swift and quickly changing channels formed by the numerous streams flowing from uncertain and ever-changing parts of the immense Valdez Glacier, situated some 4 miles north of the town. An occurrence of this nature would doubtless cause the loss of many lives.

THE RAILROAD ROUTE.

It appearing therefore that the only practicable point for establishing the business of this port was on the south side of the bay, a preliminary examination of the country from here was made to determine the best route from the harbor to the summit of the abrupt coast range. This range of mountains along the coast appears like a barrier to the interior, and consists of a succession of huge pinnacles, commonly called a saw-tooth range, with the depressions filled with vast masses of ice, forming glaciers which extend at times into the sea. At the sight of these glaciers, filling the canyons and coming well up on the sides of the mountains, it is difficult to conceive of a more forbidding and impracticable country to locate a railroad line across. A quick glance at the surroundings of the harbor assures one that up Lowe River the only possible route exists, and this at first sight appears anything but promising. However, as one journeys up the broad smooth valley of the river for some 12 miles, the country shows itself built on a larger scale than first appeared. The upper end of this valley seems to be surrounded by high mountains, but on reaching the extreme end a canyon is discovered coming in sharply from the left, and the mountain range is found split down to nearly a level with the outside valley. This gorge has been named Keystone Canyon. It is 3 miles in length and connects the upper and lower valleys of Lowe River. This upper valley is similar to the lower one in that it is broad and flat and covered for the most part to a considerable depth with gravel suited to make the best roadbed or ballast for railroad purposes. This flat is commonly known as Dutch Valley, and is 5 miles long by about 1 mile in width. At the upper end Lowe River is found to have made a small canyon for itself, which extends some 10 miles to the head of the stream. At this divide, called Marshall Pass, the drainage basin of Copper River is reached at an elevation of only 1,700 feet above sea level, and the coast range is passed. The approach to this summit on the north is a broad table-land interspersed with numerous little lakes. Beyond this summit the route would follow down Tasnuna River on the north side to Copper River, and thence up that stream through Woods Canyon to the great open valley beyond, from which points on the Tanana River, Forty Mile, and the Yukon are reached with comparatively light work and easy grade. From Dutch Valley, however, on Lowe River, it was deemed best, in order to save distance and avoid the heavy work in Woods Canyon on Copper River, to make the climb to Thompson Pass, where the trans-Alaskan trail crosses the divide, and proceed from here in a more direct route across the western drainage of Copper River, holding the elevation obtained and avoiding the heavy rockwork, low elevation, and greater distance involved in the route to Copper River via Marshall Pass.

The development of the country in the future will probably necessitate a railroad line over both routes. The line as surveyed has been so placed as to command both routes without loss of distance or grade. From Dutch Valley to Thompson Pass the elevation to be overcome is 2,000 feet. Fortunately for the success of this route, the side wall of the valley is formed by a succession of flats called "benches," which are from 50 to 500 yards wide and afford a most excellent opportunity to support a railroad line and furnish all the room desired to develop distance and reach the summit with practically any grade desired. An examination of the country from Thompson Pass down to tide water showed two possible routes, one being a supported line direct from the summit to tide water, the other by developing a line along the benches until the valley of Lowe River was reached, from which point the water grade of the stream would be followed to the bay. The direct route from the summit down, while about 6 miles shorter, involved engineering features of such magnitude that it was quickly abandoned. The main features of this route would be the crossing of several glacier streams, requiring bridges of spans varying from 500 to 1,000 feet in length and 700 to 800 feet above the streams, as well as costly rockwork along the steep cliffs, unavoidable in establishing any practicable gradient.

THE RAILROAD SURVEY.

line may demand. The next 11 miles is practically all tangent, and follows up the valley of Lowe River. The work on these sections is all in embankment and extremely light. No fill as deep as 10 feet occurs, and an average embankment of 4 feet places the roadbed safely above the highest flood. The material for making the fill on this stretch of line consists of loose gravel, unlimited in quantity and convenient of access. On section 3 the largest bridge on the line will be required for the crossing of Lowe River. This stream flows from 10,000 to 12,000 cubic feet per second in the high-water season, the volume of water gradually decreasing until late in the fall, when the flow has reduced itself to 300 cubic feet or less per second.

In providing for the maximum flow a bridge consisting of two spans of 200 feet each is recommended. From section 3 to the beginning of section 14 the line is located along the north side of the valley and crosses several side channels of the river. The flat through which the river runs is fully a mile wide on the average, and here the stream has been accustomed to make its own channels at will, sometimes spreading out in numberless channels and again confining itself to a single passage. The valley is so wide and the drainage basin of Lowe River so comparatively small that the flow of the stream can never cover the entire valley. In a few places dikes should be constructed to guide the water away from the roadbed, where it will soon cut a permanent channel and be no menace to the railroad. The material for the fill should be borrowed from the north side of the line, away from the river, leaving a berm or the natural surface of the ground for a distance of 100 feet from the base of the embankment. This will form a channel for all the side drainage in this locality, which will be guided directly to the bay, thus saving any bridges or openings from section 3 to section 14. Sections 14, 15, and 16 are in Keystone Canyon and constitute all the canyon work of the entire line to the summit and for a considerable distance beyond. In Keystone Canyon the mother rock of the country shows up to good advantage. It is all slate, as is the case with all rock observed on the line. Its cleavage is nearly vertical and easy to drill, except where small seams of quartz exist. The slate rock on the south side of the summit is firm and solid as a rule, but on the north side it is very much disintegrated. The construction of the line through the 3 miles of Keystone Canyon will be fairly heavy canyon work, somewhat similar to the average of the work through the Black Canyon of Gunnison River, on the Denver and Rio Grande Railway, in Colorado. The bed of the canyon varies from 100 to 500 feet in width. There were no marks of very high water in any part of the canyon—in fact, the vegetation growing on the low bottoms, consisting of grass, brush, and trees, indicates that, as a rule, the water does not rise more than 4 feet in nearly the whole length of the canyon.

Keystone Canyon is entered by going through a low pass in a spur divide, which forms the west side of the mouth of the canyon. This shortens the line, saves very sharp curvature, and places the roadbed safe from the wash of the river. The west side of the canyon furnishes the better route to near the head, as the east wall is more abrupt and would require the heaviest character of rockwork in order to cut a roadbed along the almost perpendicular slopes. The line therefore follows the west side to the head of the canyon and is located for the most part on the talus formed by the loose rock at the foot of the walls and about 15 feet above low water. The sidehill or side-wall cuts will make about two-thirds of the fills, the balance of the material being obtained from the gravel bars, which, as a rule, are well above the water line and close to the roadway. There is but little side drainage to the canyon, and this is easily provided for by small culverts, with the exception of Waterfall Creek, which crosses the line on section 14. This little stream forms a beautiful cascade, with falls of several hundred feet in height, and finally buries itself in the loose rock at the base of the canyon wall. Some 50 feet distant from the line this stream will require a bridge of three 16-foot spans. The profile of the line through the canyon shows short cuts and fills and sidehill work to prevail. For a quarter of a mile, about the middle of the canyon, narrows are formed by the side walls being nearer together. Here heavy rockwork is essential, and the abrupt walls for 50 to 75 feet in height will have to be cut down in order to secure room for the roadbed. At the head of the canyon the river, dashing against a perpendicular wall of rock, is sharply deflected to the left for 600 feet, and then gradually assumes its general direction, which it follows closely to the mouth of the canyon. This abrupt turn in the river necessitates a crossing of the stream, which requires a span of about 150 feet and a sharp cut through a bridge, consisting of two spans of 36 and 24 feet, supported on stone-filled cribs, and 10 feet above low water (46). This will require a bridge of 75-foot span for the railroad. As all the bridges on the military road successfully withstood the high water of 1899, this fact is considered of considerable importance in furnishing data from which to establish the grade line and length of span necessary for the railroad crossing. The light grade so far maintained of 50 feet per mile or less ends on section 19 and a heavy-grade division begins the climb to the summit. Near the foot of this heavy grade the last glacier stream is crossed (52). This will require a bridge 150 feet long. The grade from here for 2 miles follows closely the military road, then swings to the right along a fairly smooth side hill and approaches closely the outlet of the upper canyon of Lowe River. This part of the line, consisting of sections 19 to 22, inclusive, gives comparatively light side-hill work, the classification in cuts being one-third loose rock, one-fourth solid rock, and the balance pick and shovel work.

On section 22 timber line is reached at an elevation 1,050 feet above sea level. From this point to the summit the line follows up the benches, making turns on the broad parts of the flat and gradually supporting to the next bench above. All the work from section 22 to section 30 is practically side-hill excavation, with light cuts and fills, except at the points of swinging on to the flats above, where a few cuts 10 to 20 feet deep and about 200 feet long are unavoidable.

On sections 25, 27, and 30 crossings of a side drainage are made, which will require trestles from 50 to 70 feet in height by from 100 to 150 feet in length. These are the highest bridges on the line and can be replaced in the future by culverts, as the drainage basin involved is of limited area, so that no great volume of water has to be provided for. The benches crossed are covered for the most part with a dense growth of alder brush, which extends up the sides of the mountain 1,000 feet above timber line. From here to the summit moss and grass are the only vegetation grown.

From section 30 to Thompson Pass, on section 32, the route conforms to the second bench from the summit, the slope of which is practically that of the grade adopted and consequently a light fill, easy work, and curvature is here obtained.

On section 32 the crossing of the sharp ridge of the summit is made with the grade line 126 feet lower than the pass. This necessitates a tunnel from 400 to 500 feet in length and starts the line well on its way down Ptarmigan Creek, a tributary of Tickell River, one of the principal streams flowing into Copper River from the west.

To find a practicable line from tide water over the summit of the Coast Range has always been considered the key to the interior country, and this, in connection with a good harbor for all kinds of vessels, is what has heretofore been undiscovered in spite of the earnest and exhaustive search made for same. Beyond the Coast Range the interior of Alaska from Thompson Pass has been reported by all explorers as presenting no great obstacles for the location and construction of a railroad line on reasonably light grade, good alignment, and moderate cost of construction.

GAUGE OF RAILROAD.

To reduce the cost of construction on this railroad route to a minimum, it is recommended that the line be constructed on a 3-foot gauge. There is no question in Alaska of a connection with other railroads having a different gauge, where transfer of freight is essential. The vital point is to build a good line, first, upon the best location the country affords; secondly, with as little money as possible invested, so that the line can be operated to good advantage and supplies moved at the minimum cost. It is conceded that the paying freights on a narrow-gauge line bears a greater percentage to the load moved than is the case on standard-gauge routes. In the grading of the line a narrower roadbed is assured, and this alone makes a vast saving in quantities and cost, while lighter ties and rails will reduce the cost greatly at a time when the facilities for moving freight cheaply to this country and the inside of Alaska is in its infancy. As the grades and curvature of the line, as located, are so light, a change could be made later to standard gauge, if desired, without any alteration in the location of the line.

COMPARISON WITH WHITE PASS AND YUKON RAILROAD.

Compared to the narrow-gauge line now in operation from Skagway over White Pass to Lake Bennett, the only railroad now in Alaska, the thus avoiding all the complications resulting from endeavoring to develop a vast territory full of mineral wealth across 400 miles of foreign soil.

Valdez Harbor and the route via Keystone Canyon to the divide furnishes the most practicable and economical route for the development of central Alaska, and bids fair to more than hold its own for the freight business of Dawson and vicinity. With a fine harbor open the year around and a railroad route comparatively free from blockades, built on lighter grades and curvature than the other route, Valdez may well lay claim to being the main gateway for Alaska commerce.

BUSINESS.

The trade of central Alaska is comparatively an unknown quantity at the present time. A greater part of this region has yet to be explored and then prospected. Rumor has always given this country the reputation of having vast mineral deposits of copper ore, and this is being demonstrated as a fact by the few prospectors and explorers who have examined a small part of this territory.

Gold mining on Forty-Mile Creek has assumed quite an importance, and a few recent discoveries of gold south and west of the above-named place indicate that there will be several new gold mining districts developed in the near future.

The great drainage basin of Tanana River will be made cheaply accessible, and Copper River, with all of its tributaries, will be brought close to the United States in point of time and cheapness of transportation.

A main line of railway from Valdez to the Yukon will command a large amount of freight now going by other routes and greatly stimulate the settlement and development of a vast country. Branch lines will later be constructed to accommodate the business resulting from the discovery of copper and gold in this highly mineralized section. Discoveries of coal recently made at several points will expedite the work of opening up this region. What discoveries will be made the coming season no one can foretell, but it is my belief that a railway constructed immediately over the route as indicated would have a paying business as soon as it could be opened for travel and freight. Thousands of miles of profitable railway have been built in the United States in less promising regions.

VALUE OF THIS ROUTE TO THE UNITED STATES.

It is of considerable value to this country in having this main route for transportation within its own territory and, consequently, jurisdiction. Some of the many complications which have arisen in the Canadian Northwest Territory will be eliminated, and Alaska developed without the hindrance or consent of a foreign country. This deserves our patriotic consideration. Our prospectors will have an opportunity of getting into the region at the head of the Tanana River and its eastern tributaries, and on soil belonging to the United States. With a competent competing route to Dawson that country would be greatly benefited, and would aid in the settlement of pending questions with the Canadian Government.

STOCK RAISING AND FARMING.

Development of the country in the nature of farming and stock raising depends mainly upon the local market. In many sections of the country hay can be harvested cheaply and in great quantities, and all demands of this country in the future can be met by the local production. I have seen quite a variety of vegetables grown here. The soil is exceedingly productive, and I believe that the hardy farmers from Norway and Sweden would succeed in farming here as successfully as in their own country.

WATER.

There is the greatest abundance of pure water everywhere. The streams are filled with trout. Gravity pipe lines can be laid at almost any point desired, quickly securing the necessary fall to fill the water tanks along the railway line and for any other power desired.

TIMBER.

There is abundance of timber along Prince William Sound and in the interior, sufficient to furnish a good quality of material for ties, bridging, and all wood construction in general. While the trees do not grow to such size as is the case farther south, timber 3 feet in

90,000 ties, at 33⅓ cents	30,000
For laying tracks, engineering expenses, water tanks, and buildings outside of terminals	68,500
Total	753,500

Or $22,531 per mile.

The prices here used are from 25 to 50 per cent higher than is the average elsewhere in the United States. Such a line in our Western country, built upon a 15-foot roadway on fills and 20 feet in cuts would cost not more than $16,000 per mile. A direct line from Valdez to Fort Egbert, on the Yukon River, is 310 miles long. Allowing 350 miles for the length of the railway would afford all the diversion required from a direct line.

The cost of the entire line, with equipment, ready for business, will not exceed $20,000 per mile.

The members of the expedition detailed on this special work were C. E. Worthington, transit man; J. S. Grinnell, assistant transit man and leveler; B. H. Topping, rodman; D. B. Creek, J. Ingram, Oscar Johnson, axman and flagman; and Christopher Tjosvig, as cook.

The pack train of the expedition moved camp as desired, and kept the same well supplied with food.

Respectfully submitted.

EDWARD GILLETTE.

GENERAL SKETCH OF THE UPPER TANANA AND ITS WATERSHED.

(For reference, see Map of Copper River Exploring Expedition, 1899.)

OUTLINE.

The general outline of the Upper Tanana Basin bears some resemblance to an elongated horseshoe, with its immense glacier at the south end as the toe. The main valley is about 40 miles in length and varies from 2 to 7 miles in width, being broadest about 12 miles below the glacier and narrowest at its lower end. It is surrounded by mountains in every direction except toward the north, where a view of the course of the Tanana for 70 miles can be obtained, the river winding through heavily wooded foothills in that direction.

Of the valley space, from about one-sixth to one-third is taken up by the river (a large body of water of glacial origin heading in an immense glacier at the head of the valley). It has a very wide bottom and is divided into numerous comparatively shallow streams (with a current of about 7 miles per hour), occasionally cutting into its timbered banks and leaving the original bottom nearly dry. The remainder of the valley space is occupied by foothills of glacial débris (moraine), and in some instances country rock. Very few swamps of any extent exist, the valley having a fairly good drainage and the tributary streams generally consisting of merely rocky torrents cutting through deep box canyons. The mountain ranges decrease in altitude toward the north and increase toward the south until their highest point is reached, which appears to be the Wrangell group, three in the formations. The country is traversed by a number of dikes of intrusive granite, dolerite, and porphyry, the last named heavily impregnated with the sulphides of iron, copper molybdenium, and, in some instances, lead. Native copper is found in stringers and also in the creek bottoms as float; also small pieces of coal of the lignitic variety.

TIMBER.

The country is heavily timbered by spruce, cottonwood, birch, balm of Gilead, and quaking aspen. The spruce is of exceptionally good quality for the interior, trees of a diameter of 18 inches being fairly common. During the last summer a number of boats were built in this vicinity by prospectors and by them taken down the rivers. Grass is abundant, generally of the redtop variety, and exists in patches of 40 acres and upward, growing to an average height of 15 inches. Wild berries of various kinds are common, of which the following are some varieties: Currants, red and black; blueberries, raspberries, dewberries, cranberries, and, on the mountain side, crowberries.

MAMMALS, ETC.

Fox, caribou, moose, bear (cinnamon, black, and silver tip), beaver, and porcupine are met with, while sheep of the bighorn variety are plentiful. Flocks of 50 sheep are not uncommon.

Fish are plentiful in clear-water streams, trout and grayling being most commonly met with. The salmon do not run down to the Tanana head waters.

Ptarmigan are plentiful in the winter and spring; Canada grouse and pheasant during the summer months. The moor duck, mallard, and grebe, also geese, can be found nesting about every lake.

AGRICULTURAL.

Potatoes, beets, turnips, radishes, and onions of the hardy varieties would thrive. Of the cereals, oats, rye, and probably Russian wheat would do well.

SKETCH OF TRAIL, COPPER RIVER BASIN TO UPPER TANANA BASIN.

TRAIL VIA BACKENEDA CREEK TO MAIN TANANA.

Leaving the old trail at Cache Creek, at the point where Lieutenant Lowe left a cache in 1898, and following the foothills of Mount Sanford in a northeasterly direction, the trail proceeds through scattering timber and at a distance of 10 miles crosses a clear-water stream some 20 feet wide, keeping between Cornwall ridge and the foothills and still keeping the same course, crosses a rapid glacier stream, 2 feet deep, at a distance of 9 miles.

Between Cache Creek and the glacier stream the trail passes several small lakes on the right and left hand sides. About 2 miles beyond the glacier stream the trail descends toward the Copper River, which at this point is visible, as is also a gap in the Suslota Range, bearing N. 80° E., and striking the Copper River at a point about 8 miles above the Slahna River, crosses on a gravelly bottom, making an easy ford; then bearing east for a mile strikes the regular Indian trail at the mouth of Bacheneda Creek, distant 1 mile, following the creek for 2 miles, and crossing at the house of "John," an Indian chief of that district; then following the other bank for 4 miles the trail turns to the right up a bench about 150 feet high. Following this bench for 4 miles the trail forks, the right fork leading to the head waters of the Copper River, the left fork leading to Lake Tenaden, the source of the Bacheneda, distant 15 miles. Fording the Backeneda at the foot of the lake the trail forks again, the one on the right runs to the head of Lake Tenadin and then to the west fork of the Tanana.

The one on the left bears due north for 2 miles, passes another lake on the left, turns east and follows the valley about 10 miles to a third lake. This lake drains into the Tanana watershed. The trail then passes to the right of this lake and follows down the valley. The Tanana is struck 5 miles below the west fork.

This trail after turning into the Copper River bottom is heavily wooded for its entire length, the spruce timber averaging 15 inches in diameter. There is abundance of feed for horses everywhere during the summer months. At Chief John's house on the Backeneda is a patch of over 40 acres of the finest hay land, and at Lake Tenaden and the surrounding country any required amount of hay can be cut. Very little, if any, swamp land has to be traversed and comparatively no declivities to ascend or descend. The Tanana, at the point where this trail strikes it, is fordable for horses.

TRAIL TO TANANA GLACIER VIA COPPER RIVER.

This trail leaves the main Tanana trail at a point where the latter forks 8 miles above Chief John's house. Traveling south to another Indian house at the foot of Lake Zocneda, you cross a creek at the foot of the lake and follow the trail around the right side of the mountain to a small fork of the Copper River, 7 miles from the Zocneda Ford. At this point is a cache built in 1898 by Roberts & Co. Continuing up the creek for 7 miles the trail forks; the right fork leads to the Copper River Glacier, distant 8 miles. The left fork twines up a gulch in an easterly direction and passes through a box canyon. It crosses the divide at the head of the canyon summit, 7 miles distant from the fork, following the corresponding canyon on the other side to the west fork of the Tanana, 9 miles from the summit. From this point the trail continues to the main river by crossing the stream, which is easily fordable for horses. You then take the trail up a gulch due east, which you follow to the divide 8 miles distant. Continuing down the canyon you leave a small lake on the summit to the left and reach the main river 9 miles distant. On the east bank of the Tanana is a cache, which can be easily distinguished. The river is fordable at this point on gravel bottom, but not above it.

NOTES.—This trail is serviceable as a short and direct route to the headwaters of Copper River and the Tanana. There is no timber on the divides or above the canyons. Pack horses can be used, but should not be heavily laden on account of the steep grades of the ascents and descents from the divides.

TRAIL TO MENTASTA LAKE VIA BACKENEDA.

Branching from the main trail at Chief John's house and bearing due north this trail keeps to high ground, crossing the Suslota 6 miles above its mouth. Still keeping to the foothills, it follows the Slahna River to its junction with Mentasta Creek. At this point it joins the trail up the Slahna River. The trail then keeps to the right of the lake and follows the bluffs to its head, where it strikes the Mentasta Pass trail.

NOTES.—This is an old Indian trail, formerly extensively used. It is dry for the whole of its course, with the exception of the immediate bed of the Suslota and for 1 mile below its junction with the Mentasta Creek.

H. BRIAN PEARSON.

REPORT OF OSCAR ROHN ON EXPLORATION IN WRANGELL MOUNTAIN DISTRICT.

GEOLOGY.

The structural problems presented by the Wrangell Mountains are necessarily too complicated to permit of being solved, even in a general way, in the limited time and opportunity which I had at my disposal. Particularly at this time, when I have had no opportunity to study the specimens and fossils which I was able to collect, all that I can offer is a review of my field observations, hoping that they may be of some use as a preliminary to further work.

Northward from the Lowe River Valley, the rocks of which were examined and reported upon by Schrader, the conditions there existing continued to about as far as the divide at the head of Quartz Creek. Here were seen the first signs of volcanic intrusives and the nature of the rock was found to change to that of a series of micaceous and quartzose schists, probably corresponding to what Schrader has named the Klutena series. The contact between these two series is approximately east and west and crosses the valley of the Kanata below the mouths of Ernestine and Fall creeks. The effect of the change in the rock formation upon the topography is very marked. The forms become much less jagged and more rounded and regular.

The range north of the Tonsena River, so far as examined, was composed of volcanic diabases. Judging by the irregular arrangement and the similarity in irregular and much rounded forms, it is probable distance of about 4 miles through a wide canyon to the foot of the glacier in which it heads. The walls of this canyon consist of much decomposed and brecciated volcanic rocks. Just at the foot of the glacier there is a heavy ledge, probably a dike of greenish diabase, which is thoroughly impregnated with iron pyrite. The iron oxide, due to the decomposition of this pyrite, stains the mountain side for a distance of several miles on the westerly side of the glacier. On the surface of this glacier I found specimens of obsidian and very vesicular lava, both red and black, and large blocks of a very regularly bedded volcanic ash. Dikes of acid volcanics are very common. In a felsitic mass near the foot of this glacier the "flow structure" was very marked. In one dike of very light-colored acid rock the crevices were filled with sulphur and cinnabar.

About a mile below the forks, on the northern side, was a mountain, very smooth and regular in outline, entirely different from those surrounding it. Examination showed this to be composed of a granitic porphyry, which disintegrated so readily that the entire mountain side was one talus slope. This porphyry dips under the surrounding rock on all sides, and on the eastern side, where the contact was observable, it was seen to send out dikes and outlyers, which became finer in grain and redder in appearance as they receded from the main mass. The porphyry is probably a boss and may readily be the source of a great number of acid dikes seen to the eastward at the foot of the glacier. To the westward of this granitic mass the diabases again appear, but the bedding is here not marked, and, near the confluence of the second northern branch of the river, they dip under sedimentary rocks at an angle of about 45 degrees. These sedimentaries are much disturbed and fractured sandstones and shales, very much seamed by calcitic and quartzitic veinlets. The rocks are here so disturbed and so irregular that no general dip or strike could be determined. Below the third fork, however, a very heavy bed of conglomerate appears, and this strikes in a direction nearly northwest to the southeast and dips southwestward at an angle of 30 degrees. The pebbles in this conglomerate, so far as examined, were those of sedimentary rock, mostly of the shales and sandstones just described. They were clearly waterworn and were nowhere found much affected by stretching and flowage. To the westward of this conglomerate the valley widens and I was unable to examine the rocks, but the more regular features of the mountains would tend to indicate a series of less disturbed sedimentary rocks, dipped in a general southwesterly direction.

Between the foot of these mountains and the Copper River are a series of low ridges, trending in a general north and south direction and composed mainly of basic volcanic rocks. The Kotsena River runs parallel to these ridges far to the southward where it crosses them through narrow canyons.

Rocks are exposed in many places along the Chettyna River and the country to the northward. Between the Chettyna and the mountains is a rolling hummocky area in which small lakes and low-rounded rocky ridges are very numerous. The trend of these ridges is approximately east and west. So far as observed, the rocks of both the river and the valley northward seemed to be mostly of sedimentary origin, very much affected by dynamic action. They were so much folded and displaced that dip and strike could not be made out. One rather elevated mound, just west of the point where the trail leaves the bank of the river, is composed of a rock resembling, to a very marked degree, the magnetite actinolite schist of the Huronian formation of the Lake Superior region. This was cut by basic volcanic. Local magnetic attraction was very marked not only on this hill, but throughout the valley.

The mountains bordering the valley on the north are very regular in outline, and by their uniformity in appearance would seem to indicate uniform structure. Where cut by the valley of the Kuskulana, the first of these is composed of hard-ringing highly-silicified grits, shales, slates, and some schists, all of which are seamed in three or more directions by veinlets of quartz and calcite. On the second creek, entering the Kuskulana from the west, I found a bowlder containing fossils, some of which may prove sufficiently characteristic to indicate the approximate age of these rocks. Northward, along the valley of the Kuskulana, the outlines of the mountain change very rapidly. On either side of the pass, by which we left the valley, are high peaks with smooth, regular outlines and few gulches, features characteristic of the granitic porphyry peaks of the area. Several of these were seen to the northward, and between them were exceedingly ragged, craggy peaks, showing the marked bedding inclined sometimes in one direction and sometimes in another, and nowhere sufficiently disturbance. Along the valley mounds of granitic porphyry are frequent, and the entire range to the north shows the exceedingly ragged, craggy outline, characteristic of the peaks at the foot of Mount Blackburn, both at the head of the Kotsena and the Kuskulana, and everywhere showing evidences of the irregular bedding there noted.

To the northeast of the bend in the Lachena is one of these granitic boss-like mounds in which the rock has a decidedly younger appearance than that found farther west. Another one of these acid mounds occurs to the north of the pass from the Lachena to Root glacier. Just beyond this, northward, is a flat mesa top, the edge of which, seen in the vertical wall of an amphitheater at the head of a small valley, shows a series of very regularly bedded rocks that can hardly be other than of sedimentary origin. The bedding is, however, no more regular than that which, at the head of the Kotsena, was found to exist in volcanic rocks. It was impossible to reach this exposure and determine its true nature. Photographs were taken which show the bedding most beautifully.

To the south of the path the mountains are very ragged and irregular, and present irregular bands of very light-colored material alternating with others which are very dark, and may be either sedimentary or volcanic. In all probability there are beds of both volcanic and of sedimentary origin.

An isolated peak between the two great lobes of Root glacier shows the contact of a light-colored bedded rock striking approximately northwest and southeast and dipping northeast at about thirty degrees, overlying a dark-colored massive rock. This contact was traced in the mountains, both to the west and to the east of the glacier. It was again seen not only in both walls of McCarthy Creek, but also in both sides of the upper Nezena Canyon. It was impossible to reach the mountain in the forks of the glacier, but on McCarthy Creek the heavy bedded formation was found to be a dark bluish, exceedingly compact limestone bed from 500 to 1,000 feet thick. Where first observed it was very regular and little disturbed, but in the range between McCarthy Creek and the Nezena River it was found to be much contorted, fractured, and folded. In the western wall of the upper Nezena Canyon it shows great faulting and a completely recumbent fold, which was noted by Dr. Hayes. (See an Expedition through the Yukon District, by C. W. Hayes, Nat. Geog. Mag., May 15, 1892, Vol. IV, p. 140.) The rock underlying this limestone was found to be a greenish, heavy, amygdaloidal diabase. It is in this diabase that the Nicolai copper vein is found on Nicolai Creek, between McCarthy Creek and the Nezena River. The vein is formed in a fault plane near the contact between the diabase and the limestone, which is very much fractured and disturbed. The contact between these two series of rocks which appear in the mountain between the forks of Root glacier is beautifully shown in a number of photographs taken westward from the glacier and marked 18–2, 3, 4 and 5, and in the mountains east of the Nezena it is shown by 21–2 and 3, while 21–5, 6, 7 and 9 show folds in the limestone on the western side of the Nezena. While locally disturbed, as noted, this contact shows a very persistent strike and dip.

In the range between McCarthy Creek and the Nezena River there was found to the northward of the limestone and seemingly conformably upon it, a great thickness of thickly bedded, very much folded shale and slate. The effect of this upon the topography is very marked. The mountains composed of this rock are characterized by regular pyramidal outlines with few gulches. They are beautifully illustrated in the views numbered 19–3, 4 and 5. From the same peak on which these were taken, east of the head of McCarthy Creek, photographs numbered 19–7, 8 and 9 beautifully illustrate the bedding in the range to the northwest. At the very top of this peak a conglomerate is found upon the shale, which grades upward into an impure sandstone similar to that which is found unconformably in the truncated limestone and volcanics in the western wall of the Nezena Canyon, opposite Nicolai Creek. At this point the mountains present a flat, mesa-like top covered with this latter sandstone. The succession, therefore, seems to be a series of old amygdaloidal diabases. Upon these a great thickness of limestone, shales, slates, and sandstone, and unconformably upon this recent sandstone, which in turn seems to be overlain to the north by more recent volcanics. Dr. Hayes suggests that this limestone is probably of carboniferous age. The later sandstone here found resembles that found just east of the Kuskulana. Fossils were found at both of these points, and it is hoped that they may prove sufficiently characteristic to determine the ern side of the glacier, about 7 or 8 miles from the summit, the younger amygdaloidal diabases begin to appear, but the mountain immediately north of the foot of the glacier is made up of very recent, exceedingly vesicular lavas, of both a very dark and a bright red color. This mountain presents the bedded appearance and the peculiar jagged topography noted in several peaks on the summit, and beautifully illustrated in photograph 23-1. Beyond the valley, northward from the foot of the glacier, is a range of very jagged mountains, suggesting even at a distance highly inclined, much disturbed, bedded rocks. So far as I was able to observe them, these rocks were found to be of sedimentary origin. Eastward, this valley shows low, mesa topped hills, suggesting the same origin as the one noted just north of the foot of the glacier. To the westward, the valley narrows into a gulch leading to the Nabesna. To the south of the head of this gulch is a mound of granitic porphyry, similar to that described on the Chettyna side.

About 3 miles down the gulch, volcanic rocks, more or less amygdaloidal, and older than those noted farther east, are found mingling with and more or less replacing the sedimentaries. The general direction of the contact between the sedimentaries and the volcanics seems to be somewhat north of west. From here on, I had no opportunity whatever to examine the rocks, but the form of the mountains in the Mentasta Range (144) suggests that these probably present a continuation of the conditions existing in their southern extension, while the mountains in the direction of Mount Sanford have the jagged bedded appearance which characterizes the latter bedded volcanics near the glacier.

It appears, therefore, that the rocks of the area comprise a series of sedimentary formations ranging in age from the carboniferous to a very recent time, all more or less disturbed and displaced by earth movements and by volcanic rocks, ranging from old diabases and granitic porphyries to the most recent lavas.

GLACIERS.

Owing to the fact that the Wrangell Mountains are among the highest on the continent and that the low coast mountains south of them, together with the Copper River Valley, admit the moisture-laden winds from the coast, they present the heaviest glaciation of any area in Alaska equally distant from the coast. Mount Wrangell, a huge, smooth, dome-shaped mountain, is covered by one vast snow field which extends northward along the divide over both Drum and Sanford, and southward not only over Blackburn, but the entire high range east of it. This great snow field gives rise to innumerable glaciers, covering the valleys leading away from it. The largest of these glaciers is found east of Mount Regal, where it gives rise on one side to the Nezena River and on the other to the Tanana. On the Nezena side this glacier is composed of three great lobes, one of which rises at the foot of Mount Regal and flows directly east and the other two cross the range to the north and again, joining lower down, form the Tanana glacier. At the summit this presents one great field of snow and nevè, through which isolated peaks project. Their southern faces are usually bare and their northern slopes covered with a great mass of snow. The summit of the western lobe, which we crossed, is over 8,000 feet above the sea. On the Nezena side the foot of the glacier is heavily moraine covered and shows considerable activity. On the Tanana end, however, it is free from moraines and presents the smooth (**137, 138**) rounded appearance characteristic of a receding glacier.

Westward from the Nezena glacier and beyond two small glaciers at the head of the western branch of the Nezena and of McCarthy Creek, is a many-lobed glacier, draining the entire range between Mount Regal and Mount Blackburn and extending far out upon the plane below. This has been named in honor of Secretary of War Root. This is, next to the Nezena, the largest glacier of the entire area. The stream which drains this area rises to the surface as a huge spring beyond the foot of the moraine. The drainage on the southerly and westerly sides of Mount Blackburn gathers into the Kuskulana glacier. To the westward of Blackburn and Wrangell the glaciers are smaller and give rise to numerous streams which carry the drainage of this area to the Copper River. Northward from Wrangell a lobe finds its way into the Sanford. The eastern side of Wrangell and the southern side of the range east of Blackburn undoubtedly contain some large glaciers, as shown by the nature of the Nabesna River, to which they give rise. These, however, were not seen.

REPORT OF EDWARD CASHMAN.

In compliance with your request, I have the honor to submit the following report of my trip to Woods Canyon, after the 13 horses left there.

I left Valdez October 18, with four companions. One of them, Charles Anderson, made the trip from the Sawmill Camp on the Klutena River to Soldiers' Camp on Low River in one and one-half days. We had two days' supplies. The first day we camped at Dutch Camp on the Lowe River. The second day we stopped with the soldiers, who were cutting trail. The trail from Valdez to the Soldiers' Camp was very good. The third day we left camp at 8 o'clock and at half past 10 we were on top of the divide. The trail up the divide was clear of brush and on the top was level. On our left was a small bluff and a small lake. We were about the middle of the lake when we saw a bear. We shouted at him and he ran up the bluff. We soon saw him coming down on the run and watched him till he came around the lake toward us. We started to run. I was in front and had the only weapon in the crowd, a small hand hatchet. We ran about 50 yards when I looked back to see how far away the bear was and saw him running away. We were going through the pass when we saw another bear sitting on a rock, but he did not trouble us, nor we him.

We arrived at the banks of a large river at 1 o'clock. We camped for the rest of the day and looked for some flour which the soldiers told us was there. We could find none, and the next day broke camp at 8 o'clock. We went down the valley about 2 miles and started through a small canyon to our left. In going through the canyon we broke through the ice several times, my boots getting full of water, and when we got through the canyon we found a small glacier. It took us from 11 until 4 o'clock to cross it. We traveled through 2 feet of snow. It was snowing all the time. When we got off the glacier we found ourselves in a small valley, all rocks. We could not go any farther, as it was dark. We walked around a large rock all night. We started at daylight and at 10 o'clock we found some wood. We built a fire to thaw ourselves out. It took half an hour to get my boots off and I found all the toes of my left foot and the big toe of my right foot frozen. We rubbed them with snow and then started down the valley. It commenced to snow and we could not see 10 yards ahead. We traveled for four and one-half hours and came back to our camp fire again. About this time we came to the conclusion we were lost, as Anderson could not tell where he was. In the morning we climbed the mountain, but could not see on account of the weather. We lost several days in that way.

One clear day while I was up the side of the mountain I saw a large lake. I told the rest of my companions that we had better go to the lake and we would find out where we were. We started down a stream which came from the glacier. We crossed and followed it for several days. We walked on the ice, as the stream was freezing up. Streams freeze from the bottom and then from the side. In going down the stream we saw the tracks of bear and wolverines in the snow. We also saw tracks where the bear had been fishing for salmon. Both stream and lake were full of large salmon. We saw nine bears in the woods. It took us one day to walk around the lake, when I struck a trail which I recognized as the Quartz Creek trail. We were so weak at this time that we could hardly travel; but when I told the boys we could get to the rapids in a day, it braced them up; but it took us a day and a half to get there. When we arrived at the camp the people could not do enough for us. Through the kindness of Dr. Townsend, who doctored my toes, and Mr. Fishline, who gave us provisions, we were soon on our feet again. My companions stopped here and I left for Copper Center. We were eight days without a thing to eat. We saw 11 bears. It took us eleven days to make the trip. I could do it over again in four days. We kept walking too much to the northwest. It is my opinion that you can make a good trail to Copper River via Low River.

I left Copper Center November 1, with Jack Stewart and Joe Ham. We were two days getting to Nicolai's No. 2's wigwam. We stopped here about two hours. I took out the uniform you gave me to give to on. Some Indians came over and helped us to pack what was left of our goods to the bank of the river. Where we were caught in the ice jam, the Copper River was about two miles wide. We were almost opposite the Kotsena River.

It took us until Monday morning to pack our goods to where we found the horses. We found them on the same bluff that you saw them on. They had not moved off it. They had eaten everything, even the trees as far up as they could reach. We found 9 alive and 3 dead. One of the live ones was found on the river flats and it looked as if he had tumbled down the side of the bluff. One of his forward legs was broken and a piece of his tongue was hanging out of his mouth. We killed the injured animal. Stewart and I left Ham to watch the horses and started down Woods Canyon to find a place to cross over to Taral. The Copper River was about 1 mile above. The Chettyna was open as far as we could see. We found a place where the broken ice had made a small jam. We crossed over to Taral and found the old Klutch from whom you bought the fish when we went down the river. She remembered me. There was also there a buck who had just come up from Alaganick. We had a hard time to make them understand what we wanted. When we asked them for the saddles they thought we meant Seattle. They could savvy San Francisco and Seattle, but did not know what "saddles" meant. The Indian whose cache they were in lived at the mouth of the Chettyna, and as he had it locked and was away, we had to wait. We took the Indian, who was at Taral, and started to cross to the horses, but we found the ice we had crossed on was gone and there was no way to get across. The Indian told us that Chettyna was distant two sleeps.

The Indian invited us into his shack, which invitation we were very glad to take advantage of as it was very cold and we had left our blankets on the other side. This Indian we found could talk good English, as he had worked at Eyak in the summer. The Indians treated us in good style. They brought out their chinaware and gave us beans, fruit, bacon, tea, sugar, and lard for butter, also baking powder bread. They also had boiled salmon. The old Klutch, in honor of having white men in her shack, put on her best sack which was made out of a red handkerchief. She was prouder of that and her chinaware than white women are of their seal skins and silverware. We slept that night on the floor, rolled up in a moose skin, alongside of the Klutch. In the morning for breakfast we had beans, tea berries, and Klutch's last piece of bacon. After breakfast Klutch took our platter, from which we had eaten the beans, and licked it clean with her tongue. She then boiled some salmon and had her own breakfast. She offered us some, but we refused to accept. When we were ready to start she fell all over herself trying to thank us for sleeping in her house. She said, "Tanks, tanks! White man hi you; you good white men sleep here," etc. She was tickled all over to have us sleep there, as she considered it quite an honor. She would not let us thank or give her anything.

We had to go down about 3 miles from Taral in Wood Canyon before we found a place to cross. We showed the Indian the riding saddle we had, and then he knew what we meant by "saddle." This was the first time this Indian ever saw a horse. He saw the horse we shot and wanted to know if we would "pot latch him" the skin. We did so, I letting him have my knife to skin it with. He stopped with us that night, but not very willingly. We helped him to pack the horse skin, and by the time we had arrived at Taral other Indians arrived from Chettyna, and they gave us 4 pack saddles, 2 riding saddles, 14 halters, 1 saddlebag, 2 bridles, and a lot of rope. They helped us to pack them over to the other bank, but would not go up where the horses were. We bade them good-bye. They wanted to know which way we were going. We told them down to the Tasnuna. They told us we could not, as it was "high you rock and five sleep." They would not take anything from us, as they thought we did not have enough for ourselves. They gave us to understand that if we were short of grub to come back to them and they would supply us. They said: "White man ha-low muck-a-muck. Indian high-you muck-a-muck. One moon high-you cold white man no muck-a-muck. Indian pot latch hi-you muck-a-muck. In one moon high-you cold, high-you wind, white man die;" which we found pretty near right.

We had a hard job to catch the horses, as they were half wild. We built a rope corral and got them into it, but they broke through three times. We then felled trees and built a log corral and got them into it. We had to drive them into a corner and pile logs and once the horse pulled back and dropped down on top of the fire and our beans. We could not get him up and had to pull the fire out from under him. He was badly burned around the legs. We lost our beans and had to go hungry all that day and the next until we came to an Indian shack, where they gave us salmon and tea. They did not have anything else. We slept in the shack.

In going up the hill at Wood Canyon the horse which had kicked us was going up the trail by himself, when his pack caught in the roots of a fallen tree and tripped him over on his back. He rolled over and over like a rubber ball. We heard him coming and had to hustle to keep out of his way. He went by us like a shot, heels over head. We thought he would be badly injured and took a gun down to shoot him, but when we arrived at the foot of the hill he was standing up drinking at a hole in the ice, his pack on, and not a scratch on him. The weather at this time was very cold and growing colder every moment. Our fingers and faces were frost-bitten. About this time the horses commenced to give out. They would lie down and not get up. We lifted one up four times, but he could not go over 50 yards before he would drop again. We were compelled to shoot four horses in one day. One broke through the ice and we were obliged to go back about a mile and a half to an Indian shack to get an ax to cut the ice around him. We hitched two horses to him and pulled him out. Just as he got out he froze up as hard as a rock. The Indians at this part of the river were short of grub. They would feed us, but we could not buy or trade with them for grub. We cut the horse up and lived on him for four days until we arrived at the Kotsena, where Mr. Fritz made us stop for two days to rest and thaw out. He told us it was between 35° and 40° below zero.

We now had three horses and a mule, but had to shoot one of the horses here as it could go no farther. Mr. Fritz treated us very kindly, giving us all the flour he could spare. He was short himself and as his cache was at Copper Center he could not give us much. We had lost all track of time. He told us it was about a week before Thanksgiving. We left Fritz with two horses and the mule. We packed our grub on the horse that kicked us and our bedding on the remaining horse and the mule. The first day in going down a hill from the Kotsena, Stewart led the horse half way down the hill, when the mule slipped and rolled down on top of him, knocking him and the horse over, and all three rolled to the bottom of the hill together, without damage. The other horse, which we called the kicker, on account of his kicking at you at every opportunity, turned and ran back on the trail, scattering our grub and what was left of the horse meat (which we could not find at all) over the trail. I ran back and headed him off three times, but he dodged me and got away. I found afterwards that he went back to Mr. Fritz place about a week afterwards, and that Mr. Fritz cut the saddle off him and turned him loose.

We found most of our grub. It was a very cold day and the night was much colder. We made Nicolai's No. 2's house at dark and were very glad to sleep there. We slept in a storehouse. We did not need our blankets, as it was so hot we had to strip to our underclothes. The next day it was very cold and at night we camped at an abandoned Indian shack. When we stopped we were so cold we could hardly light a fire. I could not speak, as my mustache and whiskers were frozen solid. I will say right here that whiskers are a nuisance in this country, for in cold weather your breath freezes on to them. The next day we had nothing to eat except two flapjacks—one apiece—made of flour and water. At night we built a big fire. It was so cold we did not go to sleep, being afraid we would freeze. We had eight large trees ablaze. The next day we had one-half flapjack apiece, and only flour left for another one in the morning. The night was colder than the previous one. We built two fires and stood between them. Along about 4 o'clock in the morning when we were half asleep we heard a noise among the camp outfit and looked out just in time to see the mule eating the last of our flour. We got nothing to eat for the next two days until we came to Stickwan's house. The Indians at this shack could not do enough for us. All they had was dried salmon and tea. They gave us all we could eat. They even tried to get the horses into the shack. They measured their doors and then the horses to see whether they could bring them in, but as you have to crawl into their dwellings on your hands and feet, it was impossible to get the horses in. We asked them how far it was to Copper Center. They said "Halow sleep," meaning we could make it in less than a day. We were some grain. It took us two days to get to Twelve-Mile Camp at the foot of the glacier. The Klutena Lake was frozen over. From the upper end of the lake to the Twelve-Mile we broke trail (on snowshoes) from 1 to 12 feet. When we arrived at Twelve-Mile Camp the snow was so soft we would sink up to our hips every step we took. We stopped at the Sawmill Camp for dinner, and as we broke through the ice in the upper river our moccasins were wet and frozen. They thawed out while we ate dinner. In going from the Sawmill to Twelve-Mile Camp, a distance of 3 miles, Stewart froze the bottom of his feet so badly he could not move the next day. The people at the camp were very glad to see us. They heard we had gone down for the horses, and as the weather was so cold and stormy, they did not expect to see us again. I stopped with a Mr. Nolan, of Jefferson City, Mo., who treated me very kindly and cautioned us not to go over the glacier. He showed us a Norwegian by the name of Evyan who had frozen his feet trying to cross, and who Dr. Logan (who afterwards lost his life trying to get two sick men out in February) was treating. Dr. Logan came in that evening, and I helped him to dress the frozen feet. He advised us not to try to go over the glacier, as it was stormy and cold. The doctor also treated Stewart's feet. The next day, while Stewart was resting, I started to go to the foot of the glacier, a distance of about 4 miles. It took me four hours to go about 200 yards. The snow was 14 feet deep and very light and dry. I would sink up to my waist at every step.

When I returned to camp Dr. Logan told me that he would not allow us to make the attempt, if he had to stop and watch us himself. That night Evyan died. I was sleeping alongside of him. The next day Stewart and I hit the back trail, as we were afraid of getting caught in a snowstorm. Every snowstorm averaged 3 or 4 feet up there. It was well we started at the time, as the next day it commenced snowing and it was a week before anyone could get from the Sawmill to the Twelve-Mile. We went back to the rapids, where we moved our cache to Copper Center. Christmas Day I parted with Stewart, who went up the river for Forty-Mile. I stopped at Copper Center for a time, and helped a friend up as far as the Gakona River with his outfit. The weather at Christmas time averaged 35° below zero at Copper Center. While I was up the river in January it dropped to 55° or 60°. I froze my fingers and feet again. When I left Copper Center February 1 there were quite a number of men sick in the hospitals and cabins. It took me five days to get to Valdez. I spent one night on the glacier at the "fourth bench." The next morning I left the "fourth bench" at 8 o'clock in a snowstorm. It was 6 o'clock when I arrived at Valdez. I stopped at "Uncle Jim" Carlin's cabin. He treated me very kindly. I reported to Charlie Brown, the quartermaster, the next morning.

The animals I left at Copper Center consisted of a mule and a horse. I also left two pack harnesses and two halters. The mule died January 16. The horse came over the glacier and is now at Valdez. I left all the other gear at Mr. Fritz place, on the Kotsena, as we were not able to carry it. Joe Ham, who went down with me, also stopped at this place.

I wish to say a word of thanks for the Indians whom we met down the river. They treated us most kindly. They would come out 3 or 4 miles to meet us and invite us to their houses, where they would share their food with us. They make excellent tea by mixing a native leaf with English breakfast tea. They make their tobacco by rolling a piece of gunny sack in wood ashes. They prefer this to our tobacco. Whenever we went to their houses they would seat us close to the fire and look us over. If our mittens or moccasins were torn they would take them from us and repair them. Stewart's moccasins, which were worn out, were replaced by a new pair, made of moose hide in half an hour by a Klutch woman, who would take no pay from him. She seemed very happy, however, when I gave her a large safety pin, such as we use in fastening horse blankets. Another night, after they had repaired our stockings and mittens, I showed one of the Klutchers where Stewart's pants were torn at the fork. She wanted him to take them off so that she could fix them, but he was bashful and would not do so. Before he realized it, two Klutchers caught him by the arms and held him, while one pulled off his pants. He yelled at me to help him, but it was such a funny sight I could do nothing but laugh. The Klutcher fixed his pants in good shape, and was well pleased when I presented her with three old, red handkerchiefs.

We found them very pleasant and sociable. We would sing and they would sing. They knew such songs as "John Brown's Body," "March-on top of the benches, over the Klutches. The only Indian we found who lived like a white man was the one we stopped with at Taral. All of them had their own chinaware and a box to keep it in. There are about eight or ten families in each shack. The Indian whose bench is on the right side of the camp fire as you enter considers you his guest, and will feed you, but the one on the other side will not. All the bucks are sickly, looking like consumptives.

The women, as a rule, are healthy looking. They wear but one garment, something like a long shirt, open at the breast or as far down as their waist, extending a little below the knees, and a pair of moccasins, reaching above the knees. This comprises the dress of the women and children. The bucks dress up in various styles, some with mackinaw cloths, picked out of the river, others with what the white men give them. One buck had on three hats, one jammed on top of the other. They all have .45-90 rifles and cheap .32-caliber revolvers, but no cartridges. They would not eat horse meat, but took the skin off of every horse we shot. We found them very honest. They wanted to see and handle everything we possessed, but would not take anything. The uniform you sent me was as good as a pass for us. All we did was to show it and ask for Nicolai, and they could not do enough for us. They wanted to know if McKinley was high-you white chief. Nicolai was 25 miles up the Chettyna River when I arrived at Taral. I gave the uniform to the Indian who helped us over the river with the pack saddles. It was about four sizes too small for him, but he managed to squeeze into it. The Indians at the mouth of the Kotsena River had some good pieces of copper, which they told me they got on the Kotsena and Chettyna rivers. The country traveled through down at Wood Canyon was pretty rough, but well wooded, with large quantities of grass in places. When I left Copper Center for Valdez the snow was about 39 inches deep. At the lake it was about 5 feet deep, at Twelve-Mile Camp, about 15 feet deep, and at the foot of the glacier I could not get bottom. Judging from appearances, it must have been 20 feet deep. Compared with last winter, I found very little snow on the glacier when I crossed it. Coming over the fourth bench, where you crossed with the horses last summer, the ice ridge wasn't covered. I broke through in one place between two ridges, and found only 2 to 3 inches of snow bridging the crevasse. While I was in the inside I did not mind the cold very much. I came out to Valdez with the same rig I had on at the Center, and felt the cold more than I did on the inside, and they told me the lowest it was at Valdez was 8° below zero.

Yours, etc.,

EDWARD CASHMAN.

O

1.—STEAMER EXCELSIOR AT SEATTLE. APRIL 12, 1899.

This vessel carried the expedition to Alaska.

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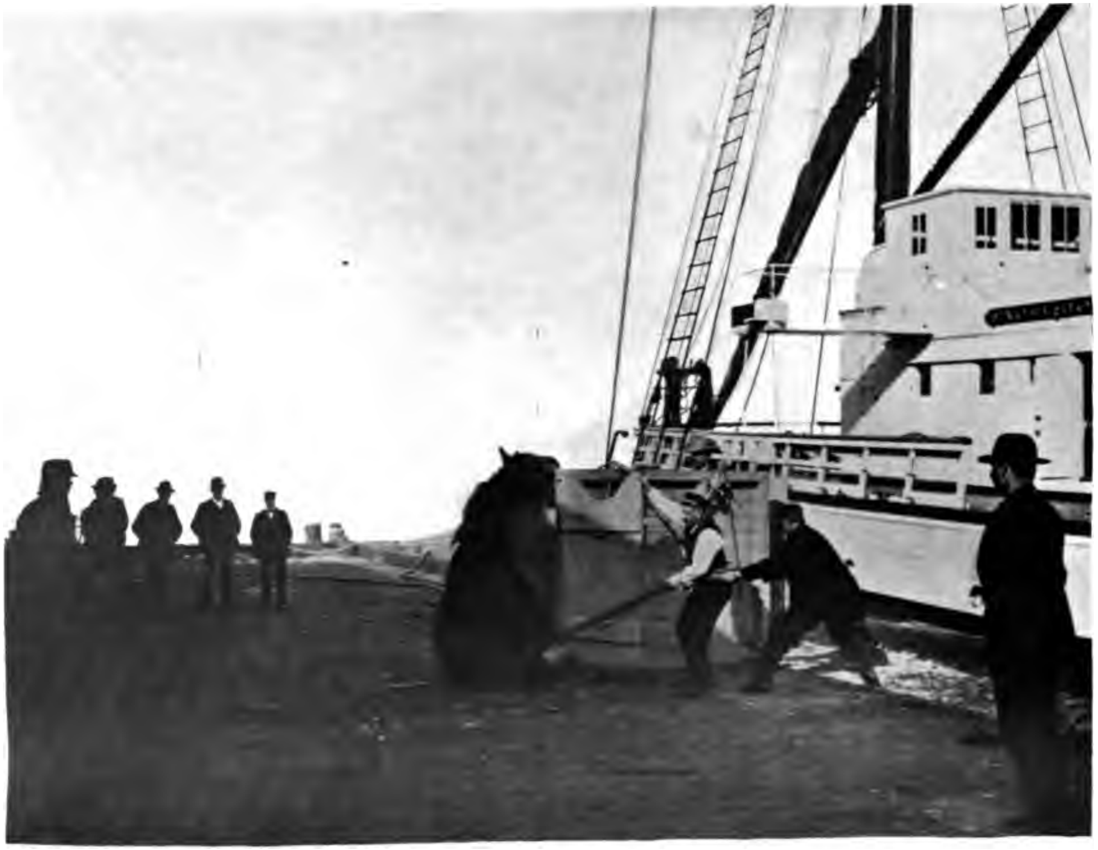

2.—LOADING HORSES ON STEAMER EXCELSIOR FOR THE EXPEDITION, SEATTLE. APRIL 15, 1899.

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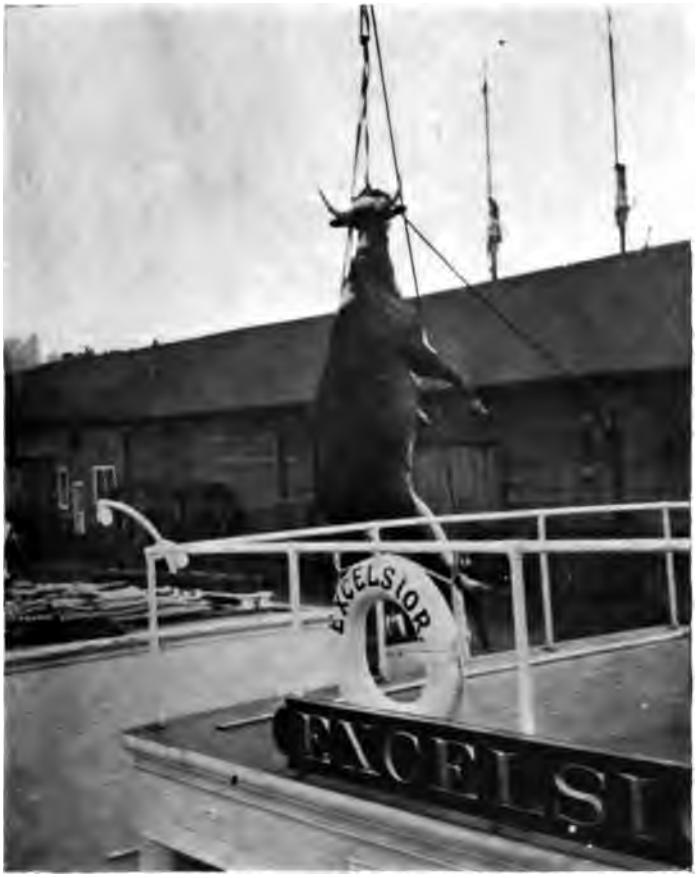
3.—LOADING HORSES ON STEAMER EXCELSIOR FOR THE EXPEDITION, SEATTLE. APRIL 15, 1899.



4.—LOADING BEEF CATTLE ON STEAMER EXCELSIOR AT SEATTLE.
APRIL 15, 1899.

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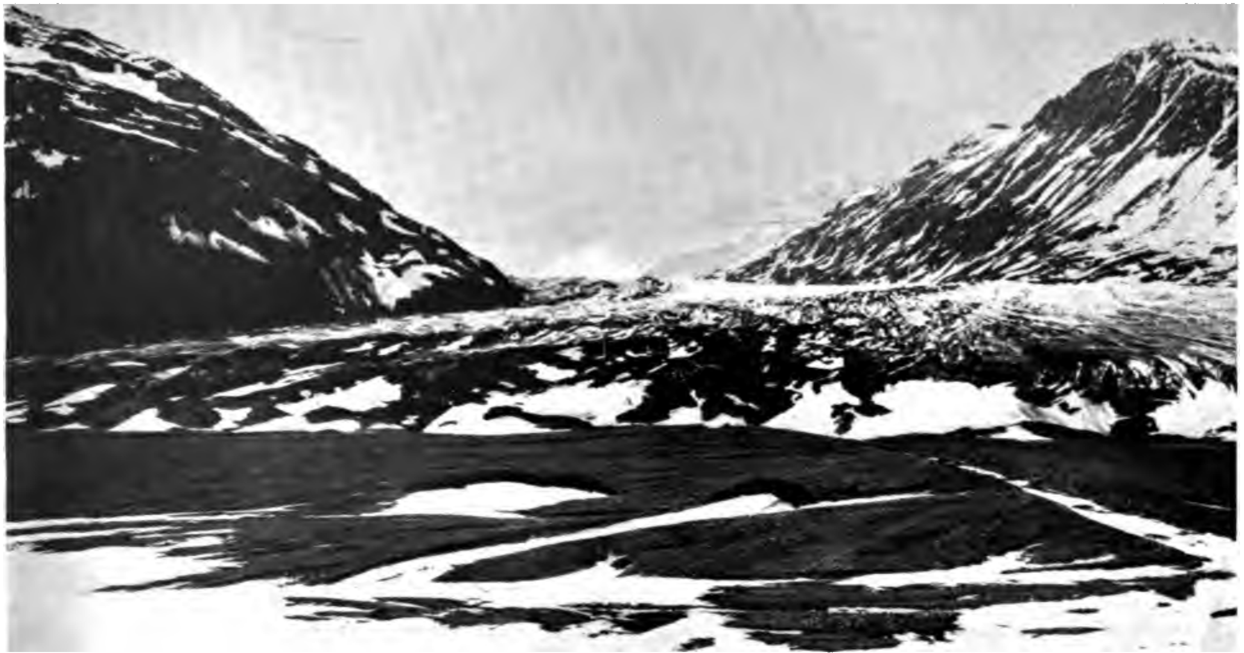
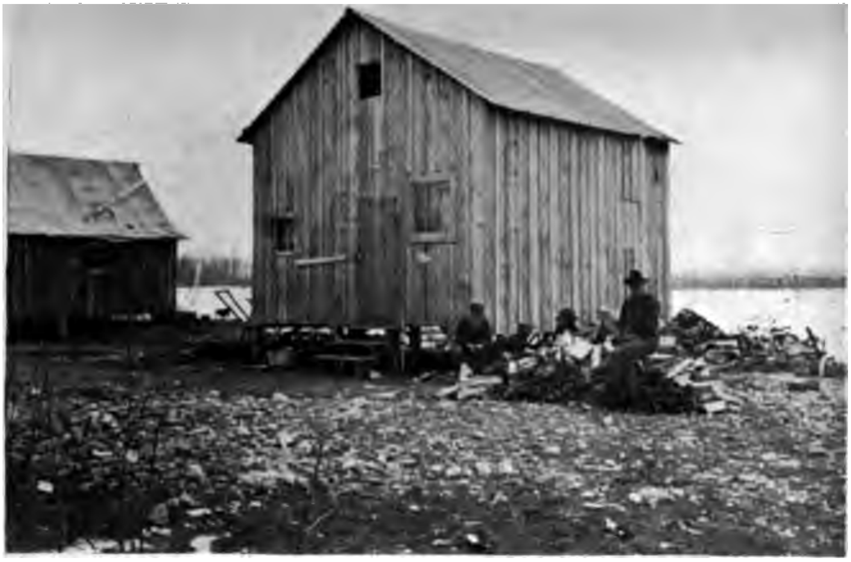


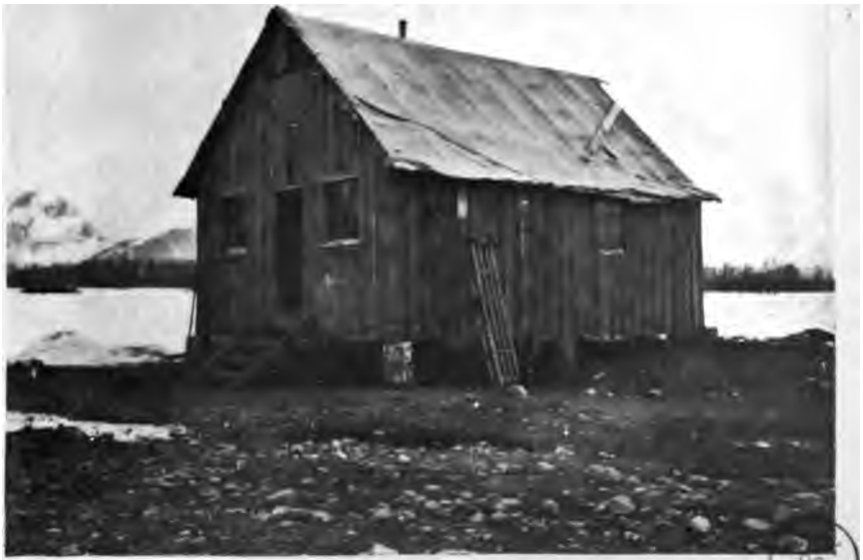
6.—VALDEZ GLACIER FROM AN ELEVATION OF 3,000 FEET. MAY 20, 1899.

7.—CHARLES BROWN, QUARTERMASTER'S AGENT.

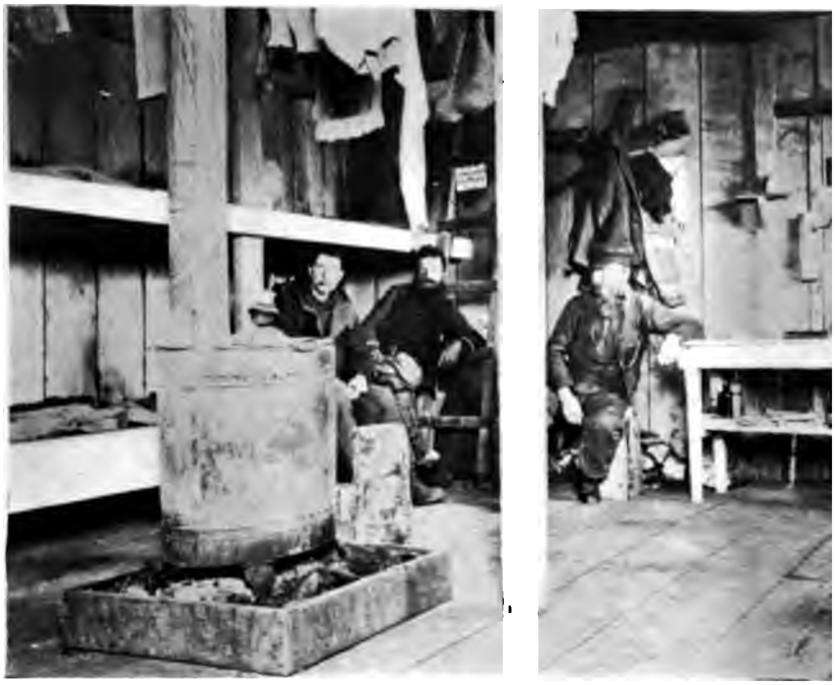
8.—QUARTERMASTER-SERGEANT PHILIP GLESENER, U. S. A.



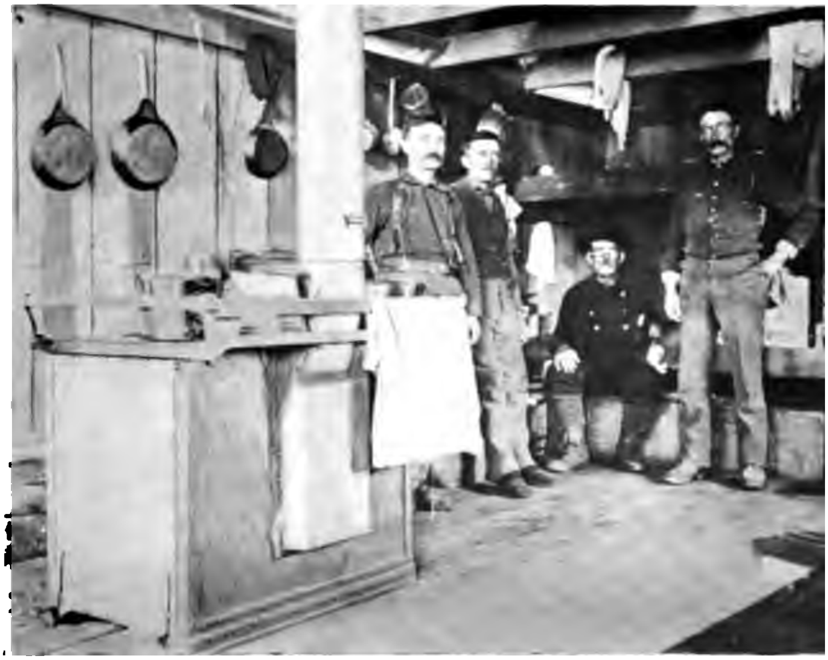
9.—SCURVY HOSPITAL FOR DESTITUTE MINERS AT VALDEZ. MAY 9, 1899.



10.—KITCHEN OF HOSPITAL FOR DESTITUTE MINERS AT VALDEZ. MAY 9, 1899.

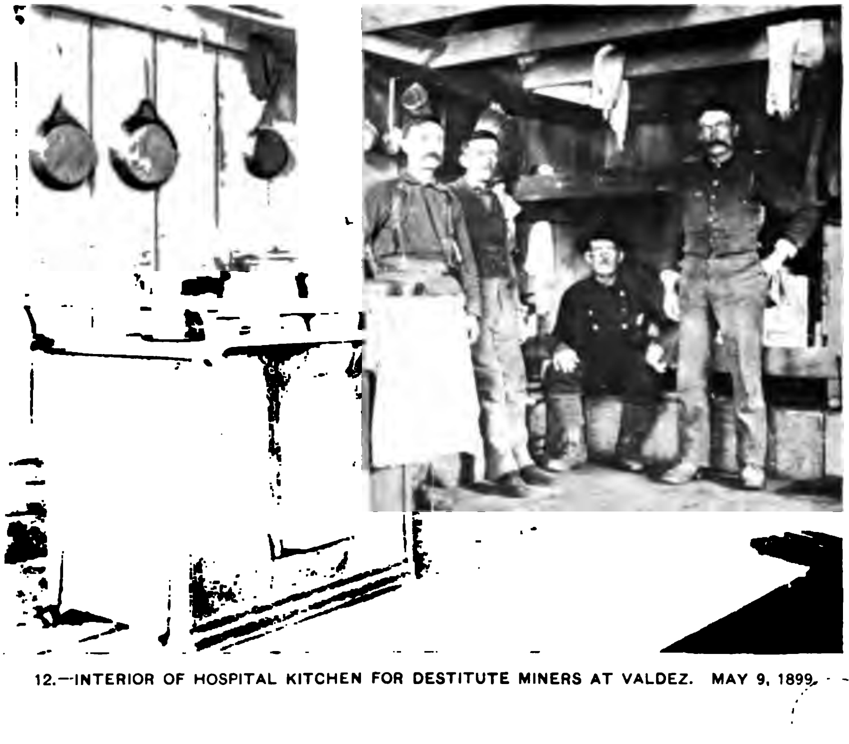


11.—INTERIOR OF SCURVY HOSPITAL FOR DESTITUTE MINERS AT VALDEZ. MAY 9, 1899.



12.—INTERIOR OF HOSPITAL KITCHEN FOR DESTITUTE MINERS AT VALDEZ. MAY 9, 1899.

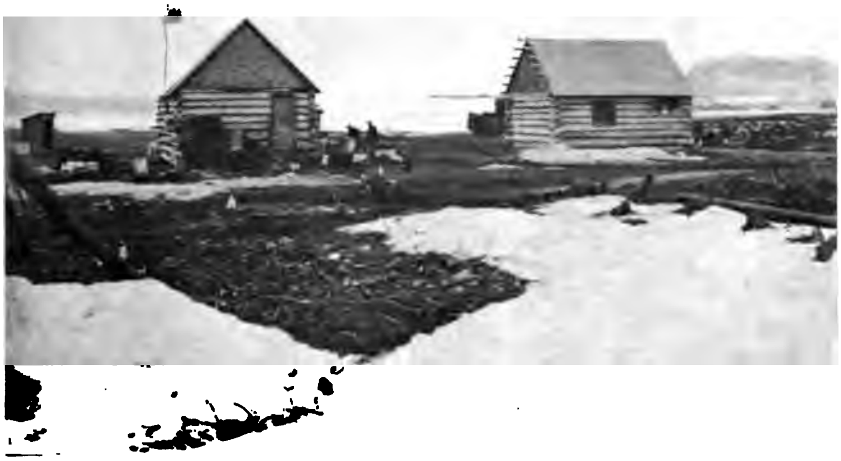
11.—INTERIOR OF SCURVY HOSPITAL FOR DESTITUTE MINERS AT VALDEZ. MAY 9, 1899.



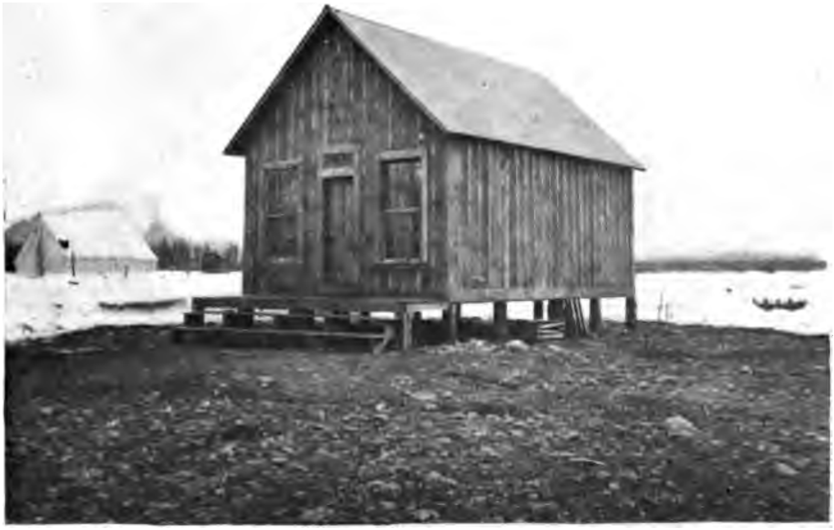
12.—INTERIOR OF HOSPITAL KITCHEN FOR DESTITUTE MINERS AT VALDEZ. MAY 9, 1899.

15.—BUILDING HIRED FOR USE AS ADJUTANT'S OFFICE, COPPER RIVER EXPLORING EXPEDITION. MAY 9, 1899.

16.—BUILDING HIRED AS COOK HOUSE FOR EXPEDITION. MAY 9, 1899.



17.—COOK HOUSE (LEFT) AND ADJUTANT'S OFFICE (RIGHT) AT VALDEZ. MAY 9, 1899.



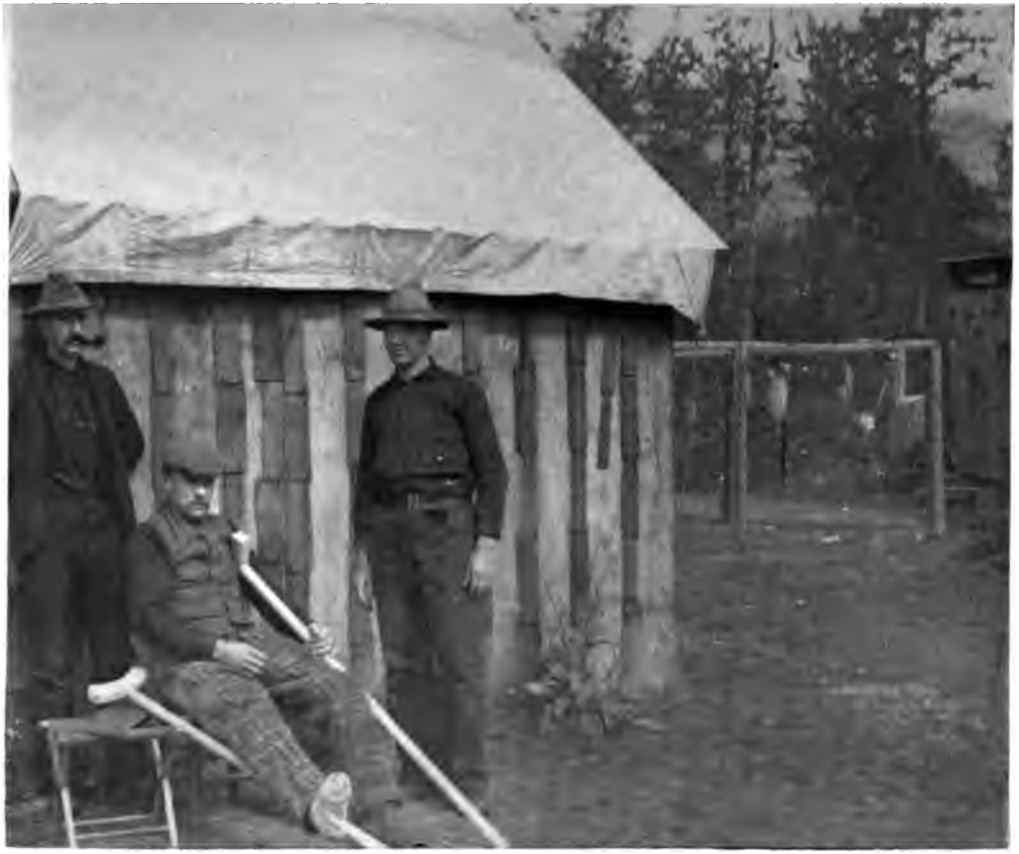
18.—COMMISSARY STOREHOUSE AT VALDEZ. MAY 9, 1899.

19.—POLICING VICINITY OF CAMP AT VALDEZ TO GUARD AGAINST TYPHOID FEVER. MAY 15, 1899.

20.—BUILDING HIRED FOR USE AS A DARK ROOM FOR PHOTOGRAPHIC WORK OF THE EXPEDITION. MAY 9, 1899.

11.—INTERIOR OF SCURVY HOSPITAL FOR DESTITUTE MINERS AT VALDEZ. MAY 9, 1899.

12.—INTERIOR OF HOSPITAL KITCHEN FOR DESTITUTE MINERS AT VALDEZ. MAY 9, 1899.



21.—SUMMER HOSPITAL. DR. TREW, A PATIENT AND AN ATTENDANT. AUGUST 7, 1899.

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15.—BUILDING HIRED FOR USE AS ADJUTANT'S OFFICE, COPPER RIVER EXPLORING EXPEDITION. MAY 9, 1899.

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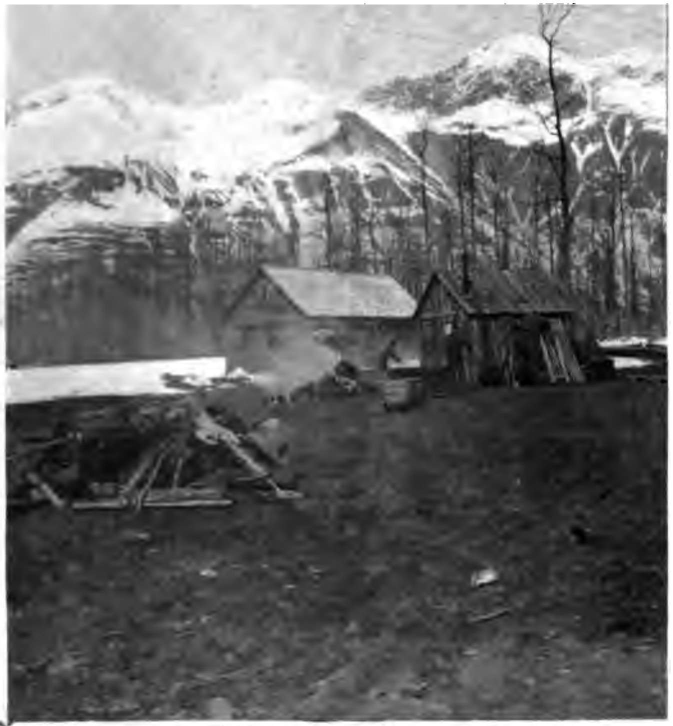
17.—COOK HOUSE (LEFT) AND ADJUTANT'S OFFICE (RIGHT) AT VALDEZ. MAY 9, 1899.

18.—COMMISSARY STOREHOUSE AT VALDEZ. MAY 9, 1899.



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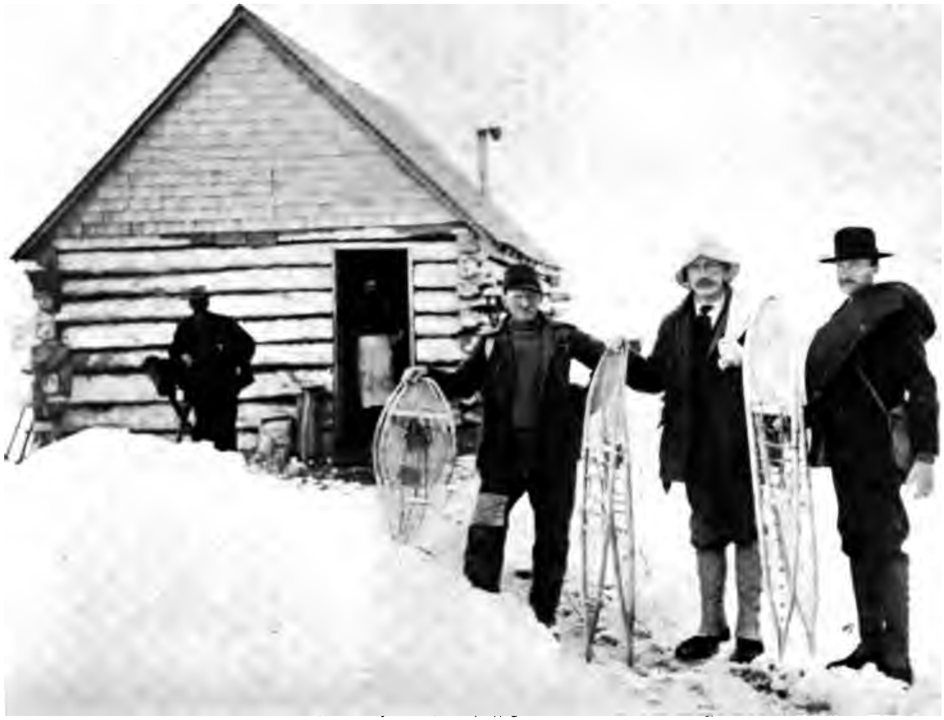

25.—THE FIRST RECONNAISSANCE PARTY TO LEAVE VALDEZ FOR STATION NO. 2. COOK HOUSE IN BACKGROUND. APRIL 25, 1899.

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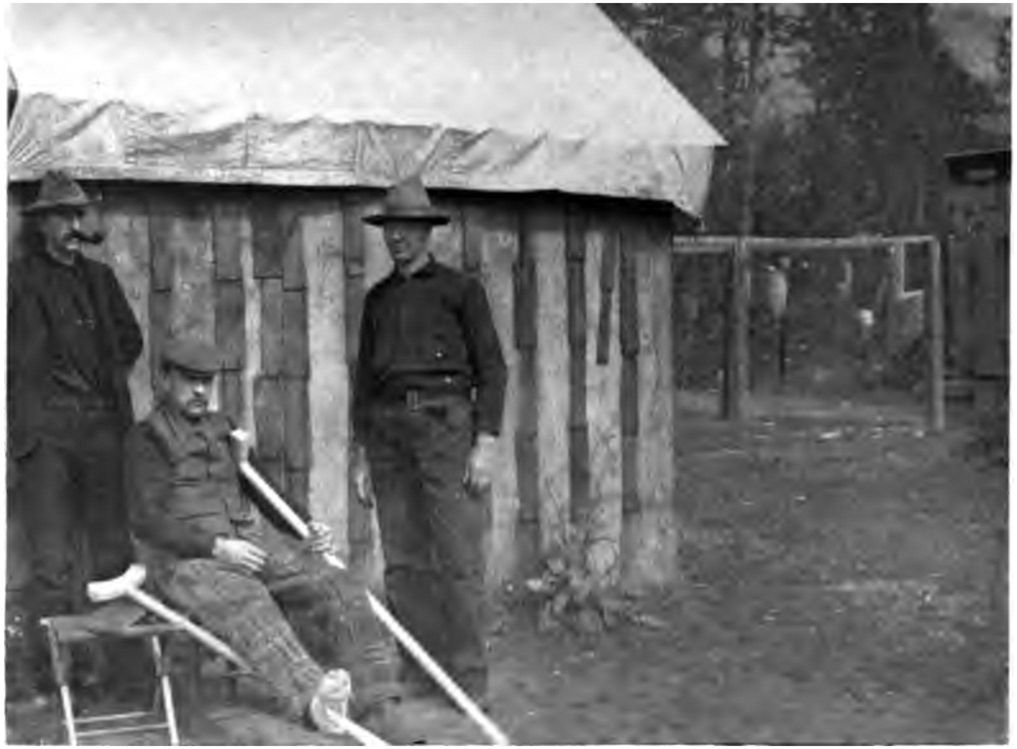
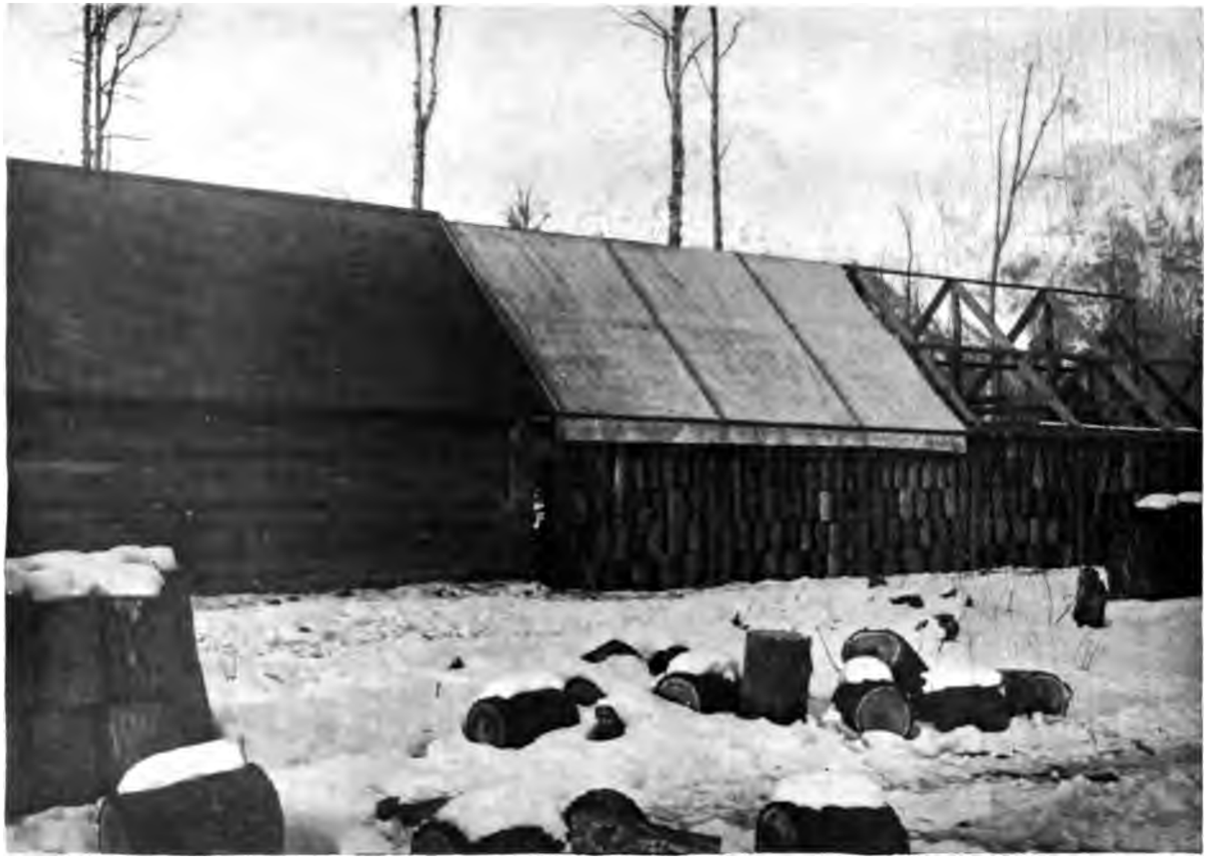


21. SUMMER HOSPITAL. DR. TREW, A PATIENT AND AN ATTENDANT. AUGUST 7, 1899.

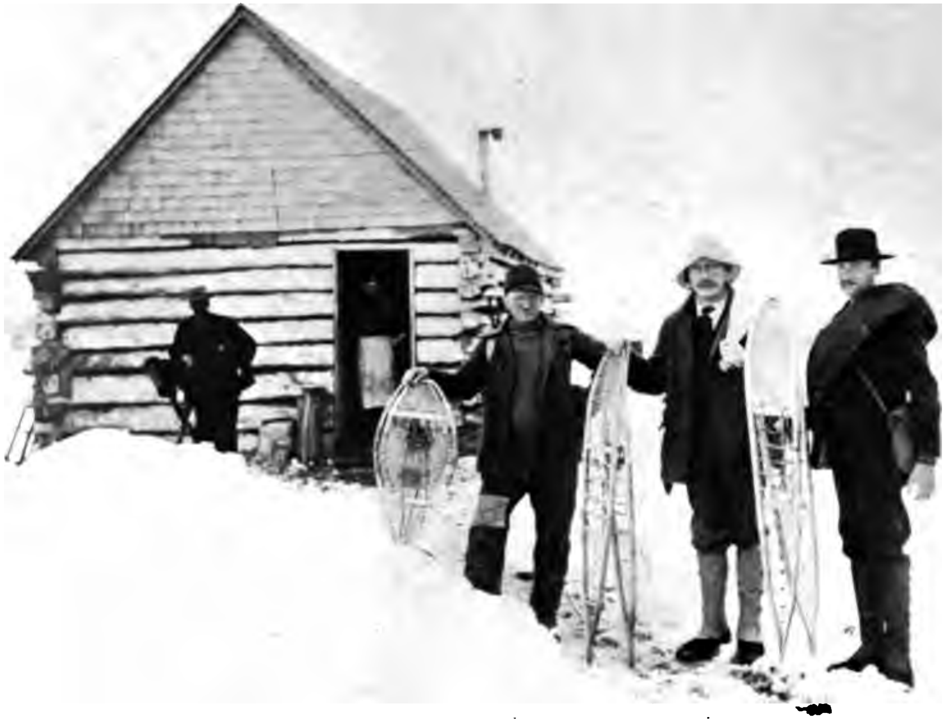


22.—BUNK HOUSE AND WOOD AND HAY SHED AT VALDEZ. OCTOBER 23, 1899.

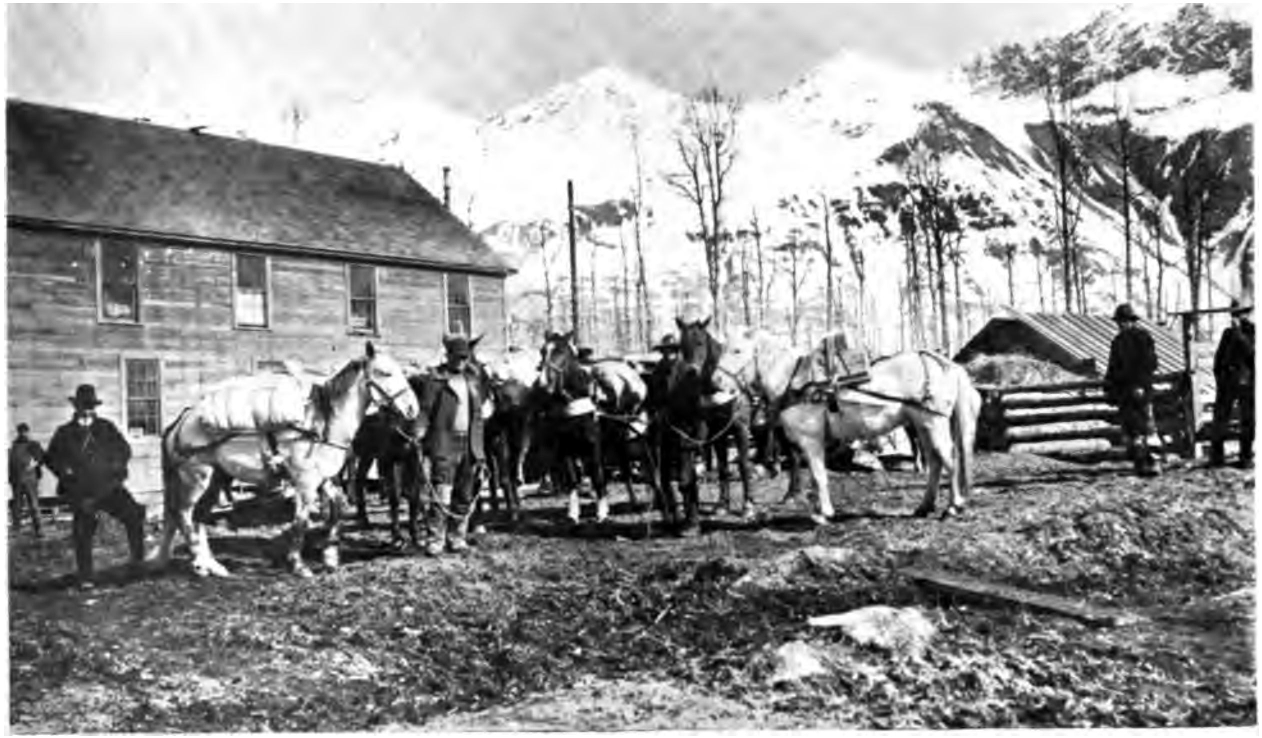
23.—NEAR THE FOURTH BENCH OF VALDEZ GLACIER, ON TRIP TO ESTABLISH RELIEF STATION AT KLUTENA RAPIDS. MAY 8, 1899.

24.—ONE OF THE DOG TEAMS OF THE EXPEDITION AT VALDEZ. APRIL 25, 1899.

The usual load is about 100 pounds to a dog.

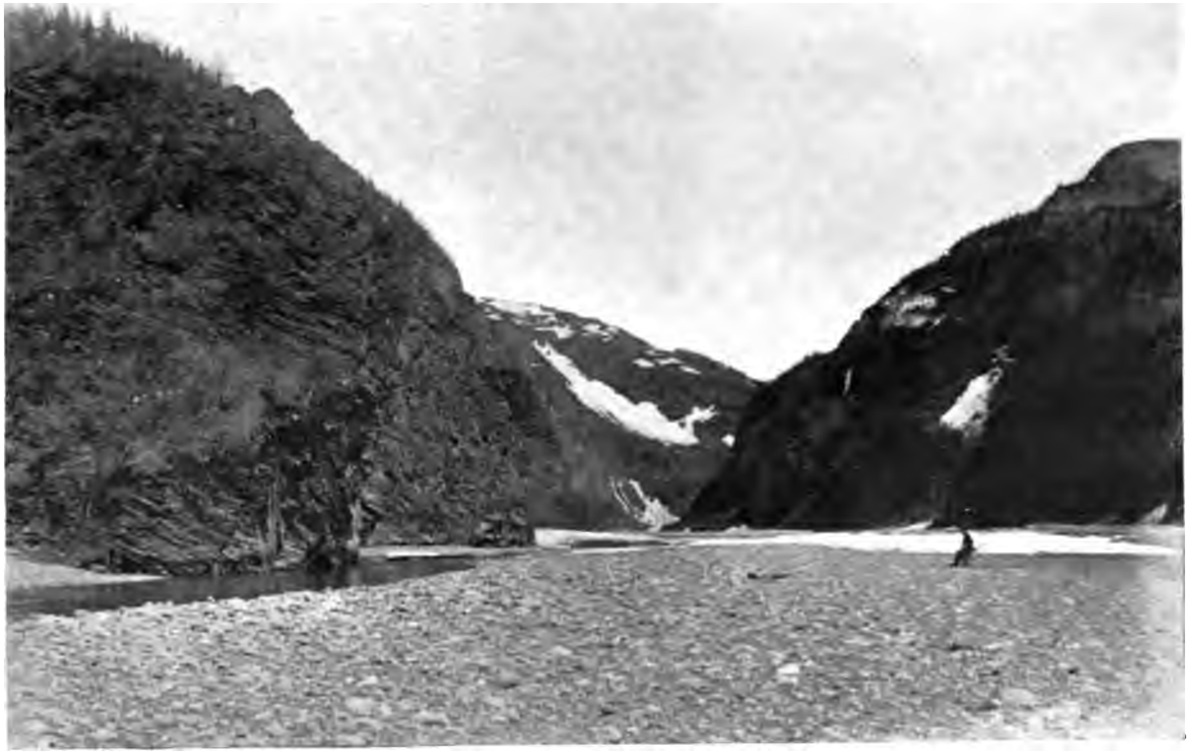


25.—THE FIRST RECONNAISSANCE PARTY TO LEAVE VALDEZ FOR STATION NO. 2. COOK HOUSE IN BACKGROUND. APRIL 25, 1899.

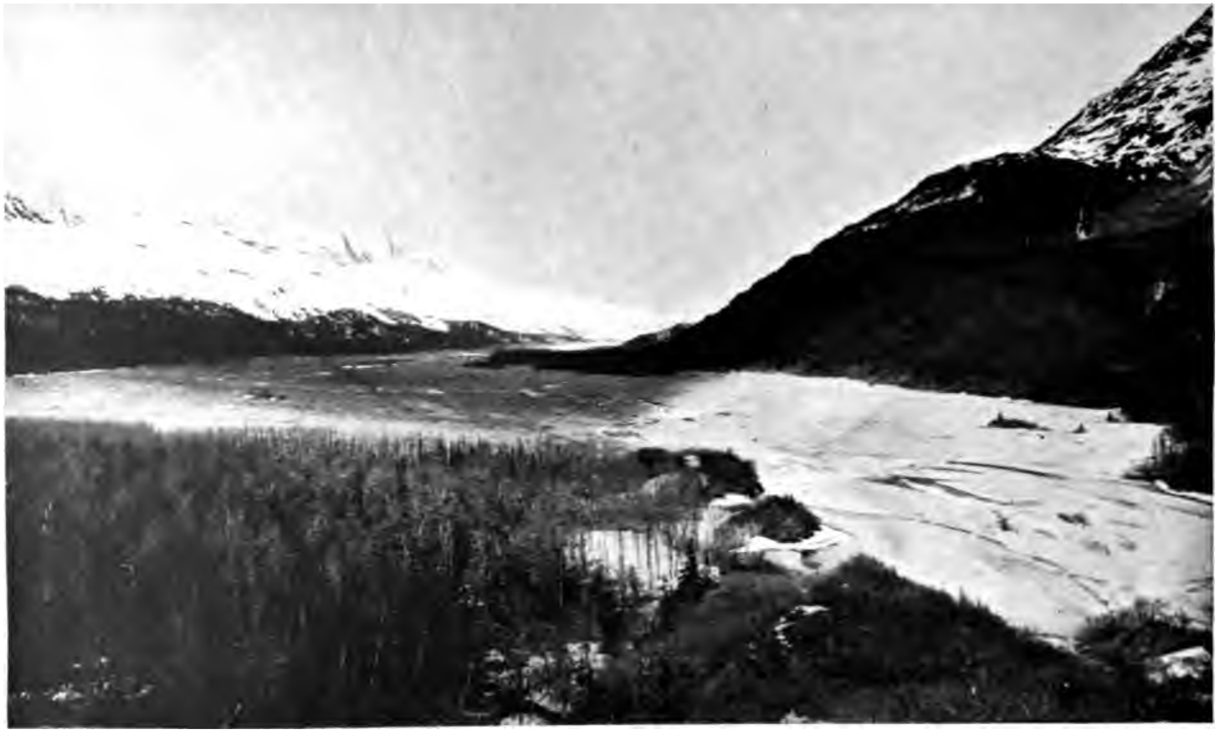


26.—PART OF PACK TRAIN AT CORRAL AT VALDEZ, ABOUT TO START ON FIRST TRIP TO STATION NO. 2. APRIL 29, 1899.

The frame building on the left is the "hotel."



27.—SOUTHERN ENTRANCE TO KEYSTONE CANYON. MAY 12, 1899.



28.—LOOKING DOWN LOWE RIVER FLOOD PLAIN FROM POINT NEAR SOUTHERN ENTRANCE TO KEYSTONE CANYON. PART OF VALDEZ BAY IN THE DISTANCE. MAY 16, 1899.

The road is along the sidehills on the right.

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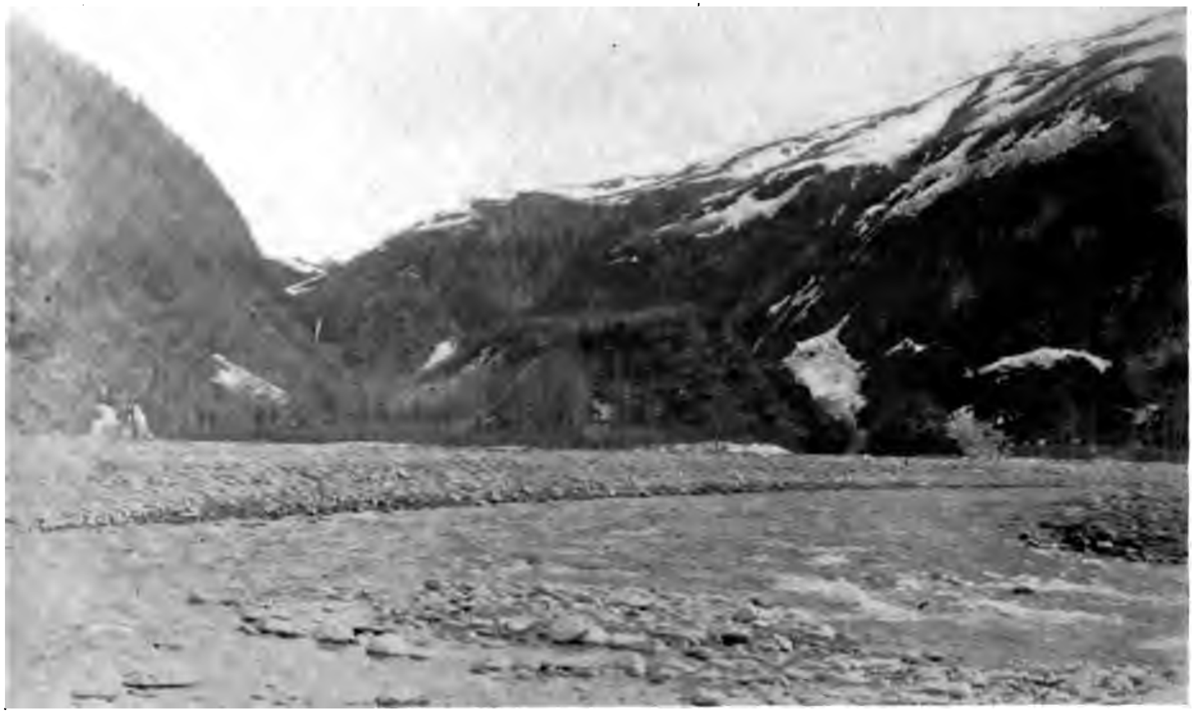
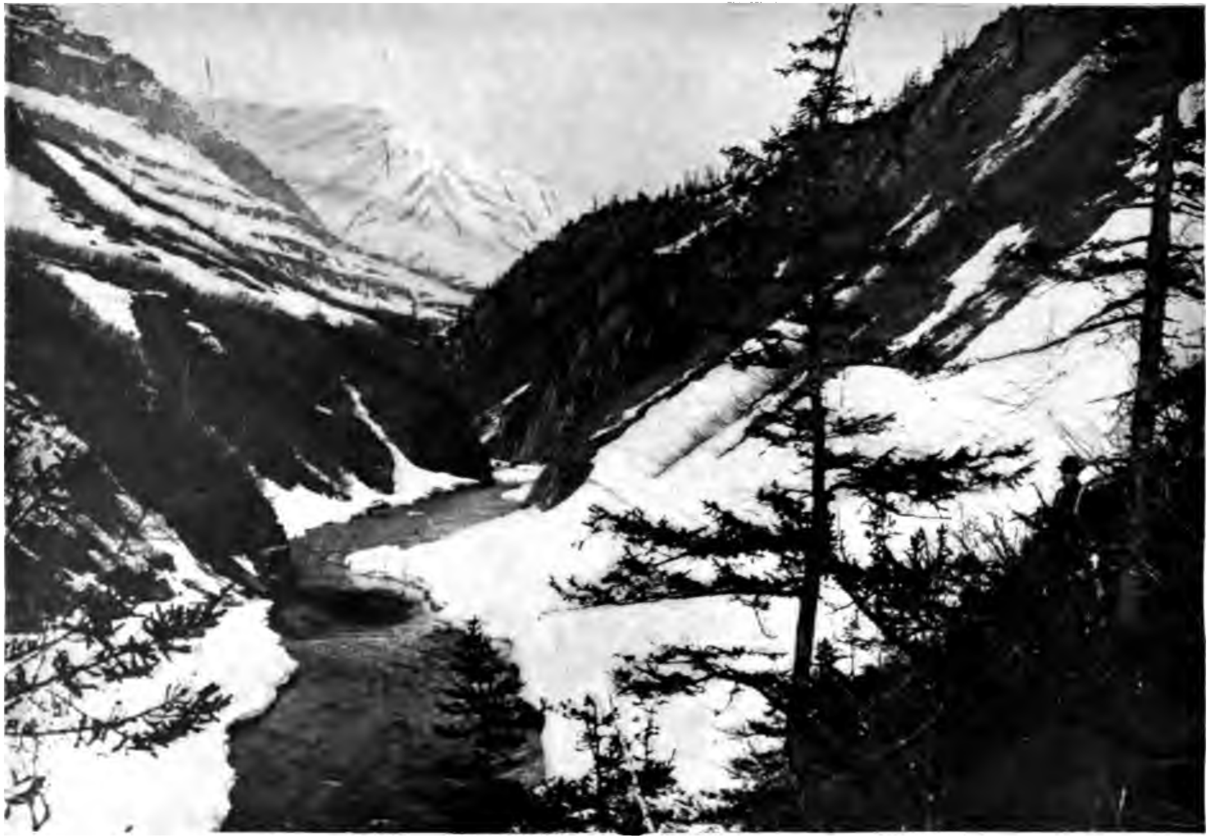
29.—SITE OF STATION NO. 2, BEFORE BRUSH WAS CLEARED. APRIL 29, 1899.

30.—SITE OF STATION NO. 2; SAME AS NO. 29. APRIL 29, 1899.

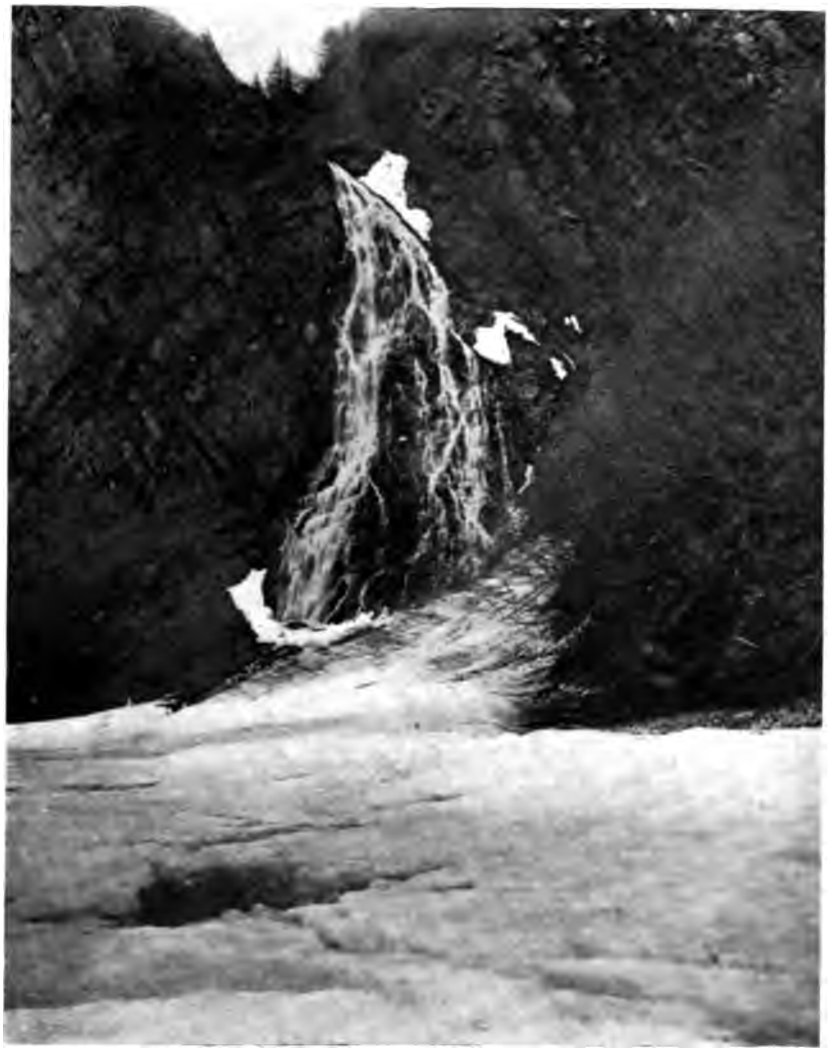
31.—PERSONNEL OF COPPER RIVER EXPLORING EXPEDITION ON BEACH AT VALDEZ. APRIL 25, 1899.



32.—LOWE RIVER AND SOUTHERN ENTRANCE TO KEYSTONE CANYON. MAY 12, 1899.

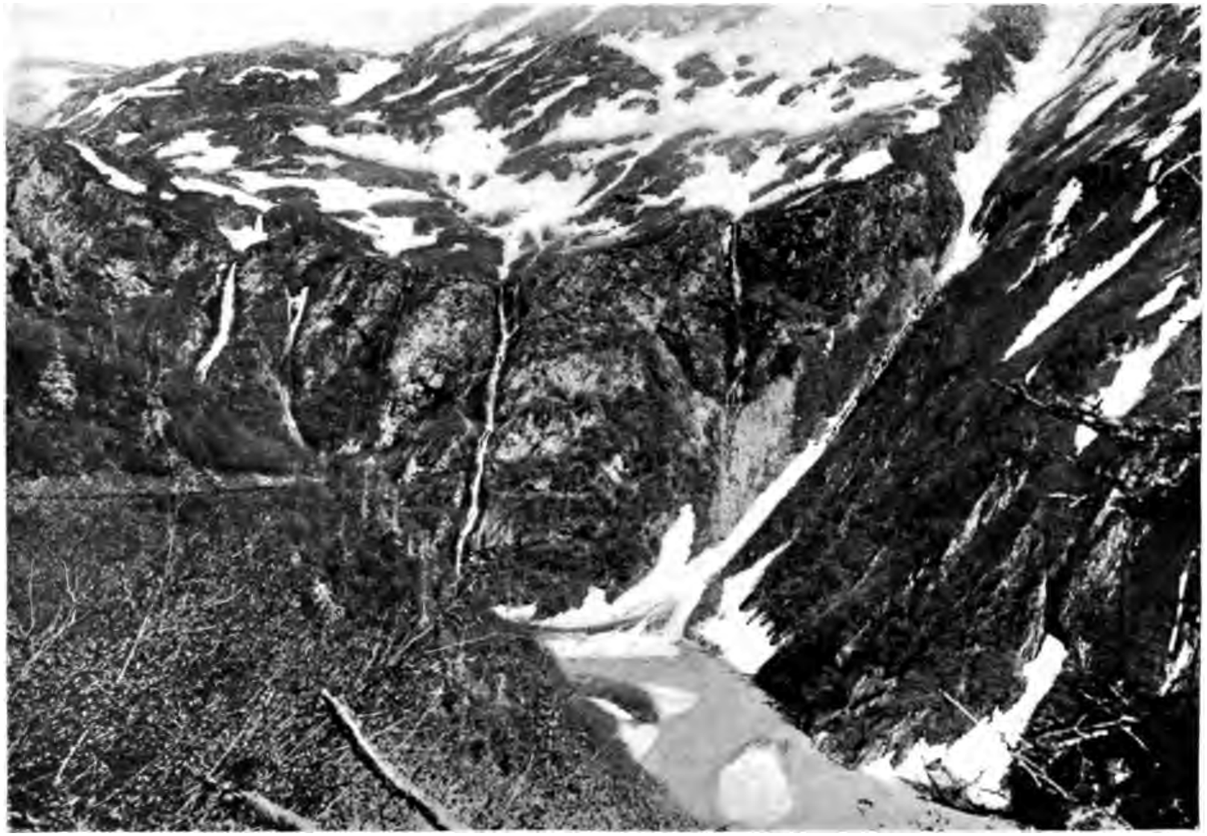


33.—KEYSTONE CANYON HALFWAY THROUGH, LOOKING NORTH. MAY 15, 1899.



34.—WATERFALL ON WEST SIDE OF KEYSTONE CANYON. MAY 12, 1899.

In the ravine above the fall was situated construction camp No. 2.



35.—IN KEYSTONE CANYON, ONE-HALF MILE FROM SOUTHERN ENTRANCE; SHOWING ROAD ON THE LEFT. JUNE 9, 1899.

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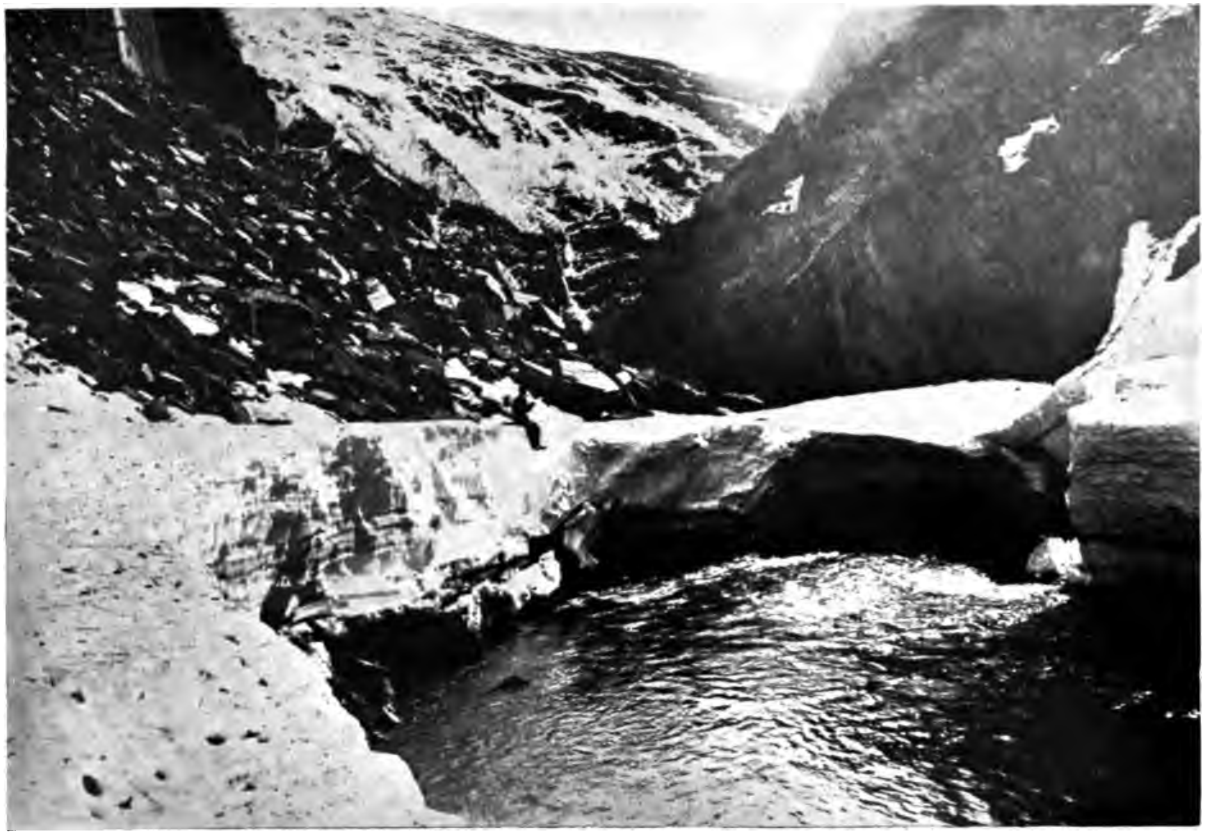
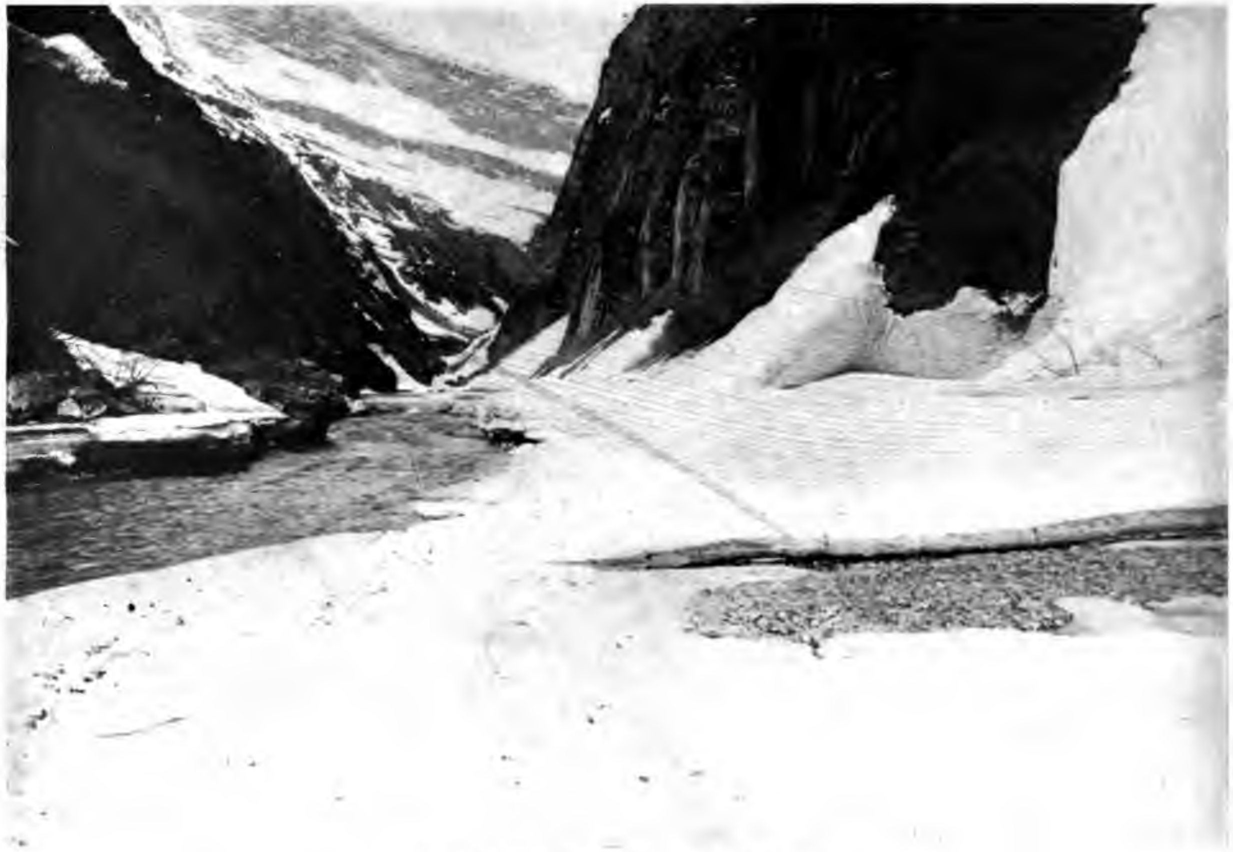
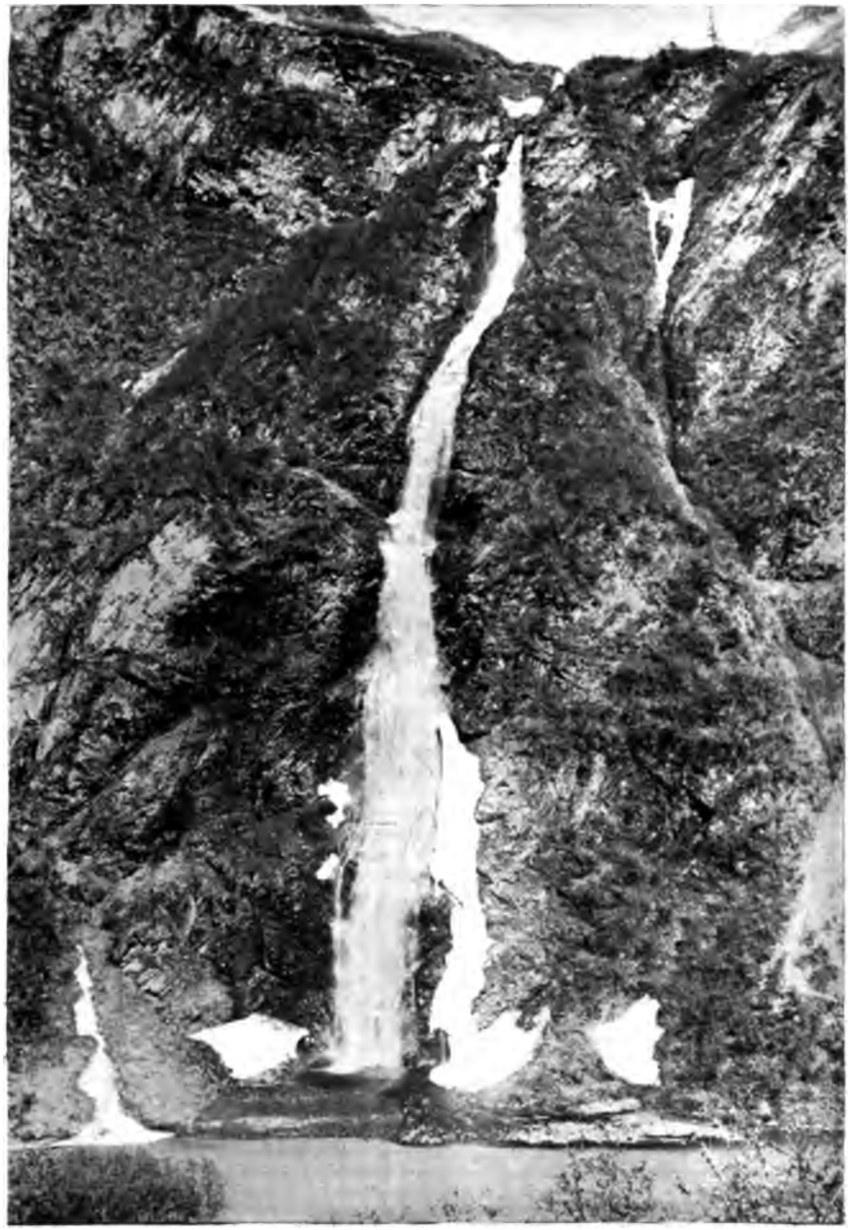


36.—SNOW BRIDGE IN KEYSTONE CANYON, 1¼ MILES FROM SOUTH ENTRANCE, LOOKING SOUTH. MAY 15, 1899.



37.—IN KEYSTONE CANYON. MAY 15, 1899.

The road is about 400 feet above the bottom, along the ledges on the left.



38.—WATERFALL IN KEYSTONE CANYON, OVER 700 FEET HIGH. JUNE 9, 1899.

The canyon is not over 250 yards wide at this point.

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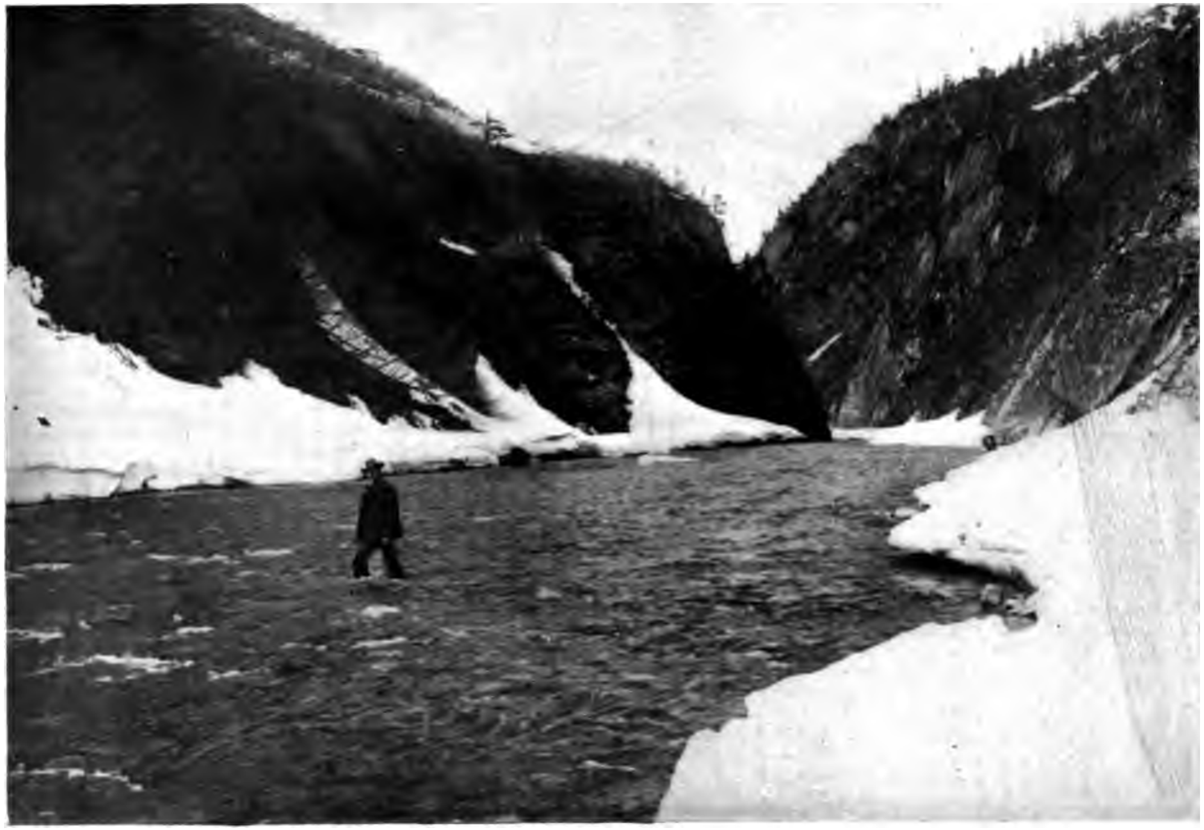
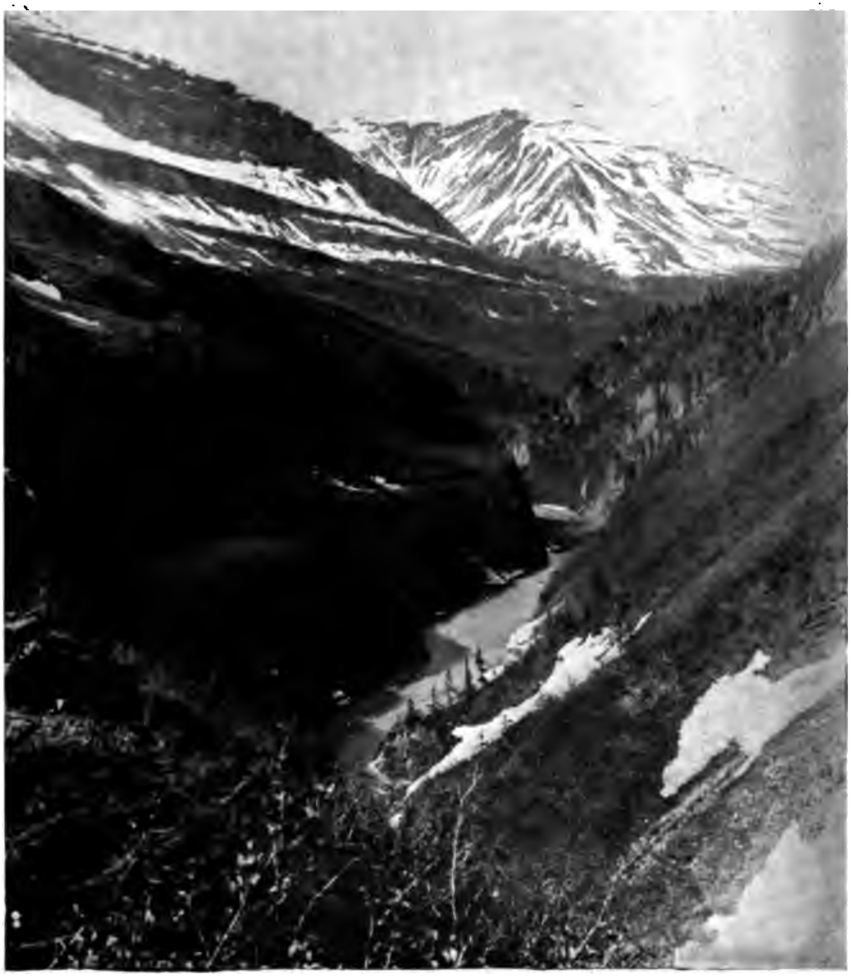


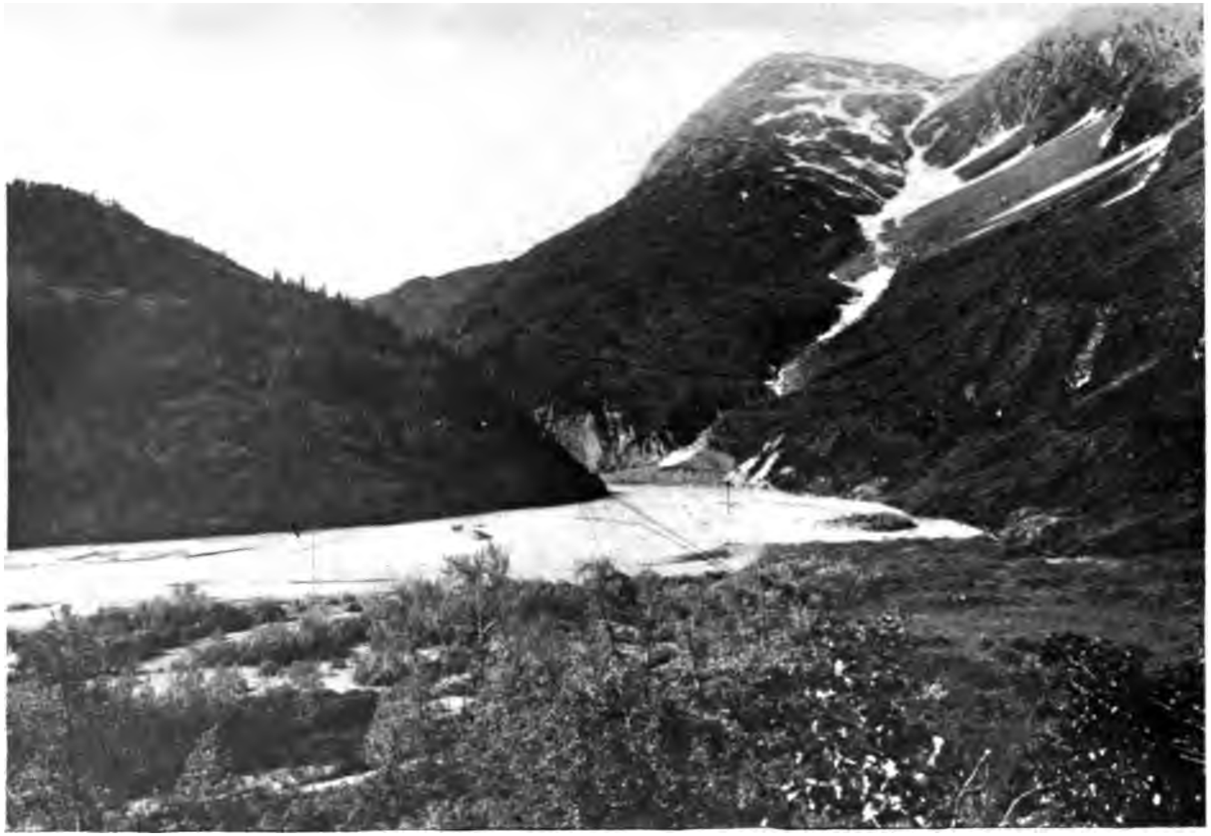
39.—LOOKING UP KEYSTONE CANYON, 1 MILE FROM NORTH END. MAY 15, 1899.

The road is built along the bench on left side.

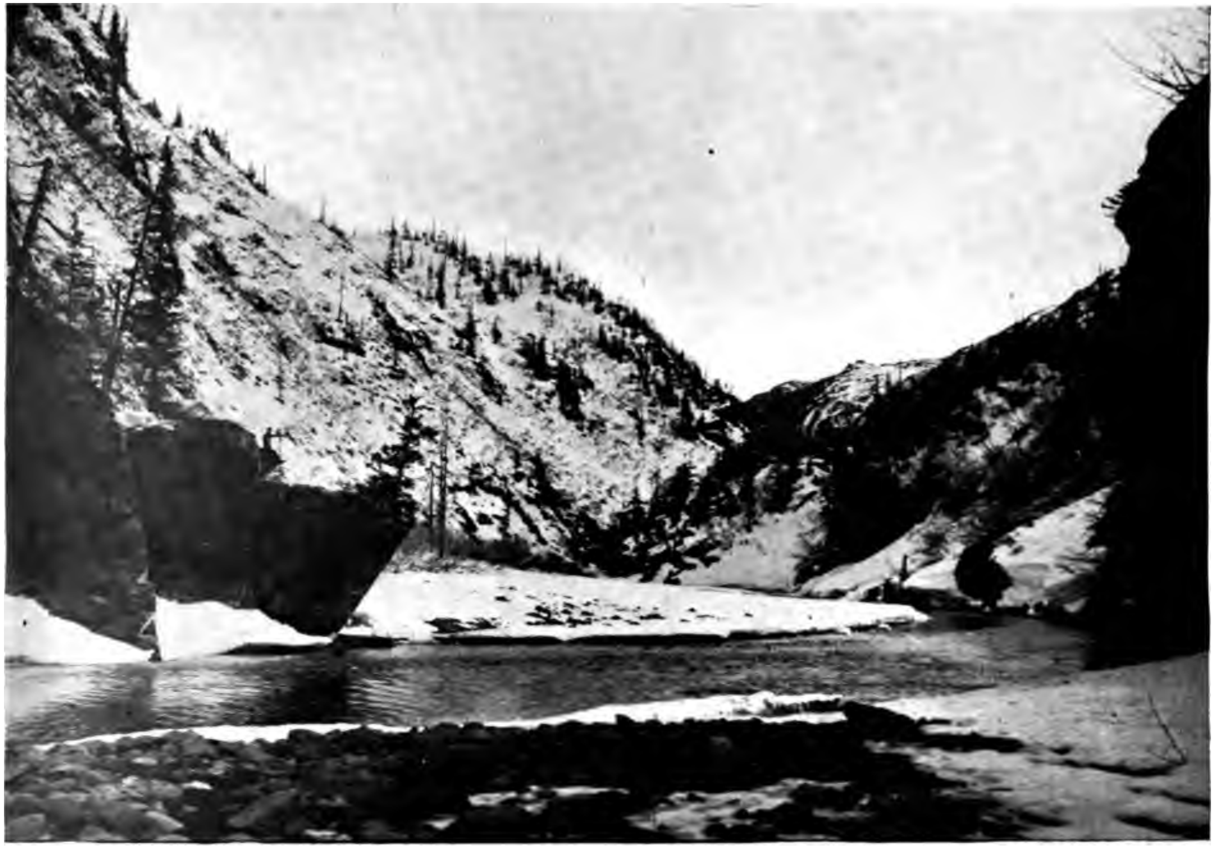


40.—KEYSTONE CANYON, HALFWAY THROUGH, LOOKING NORTH.

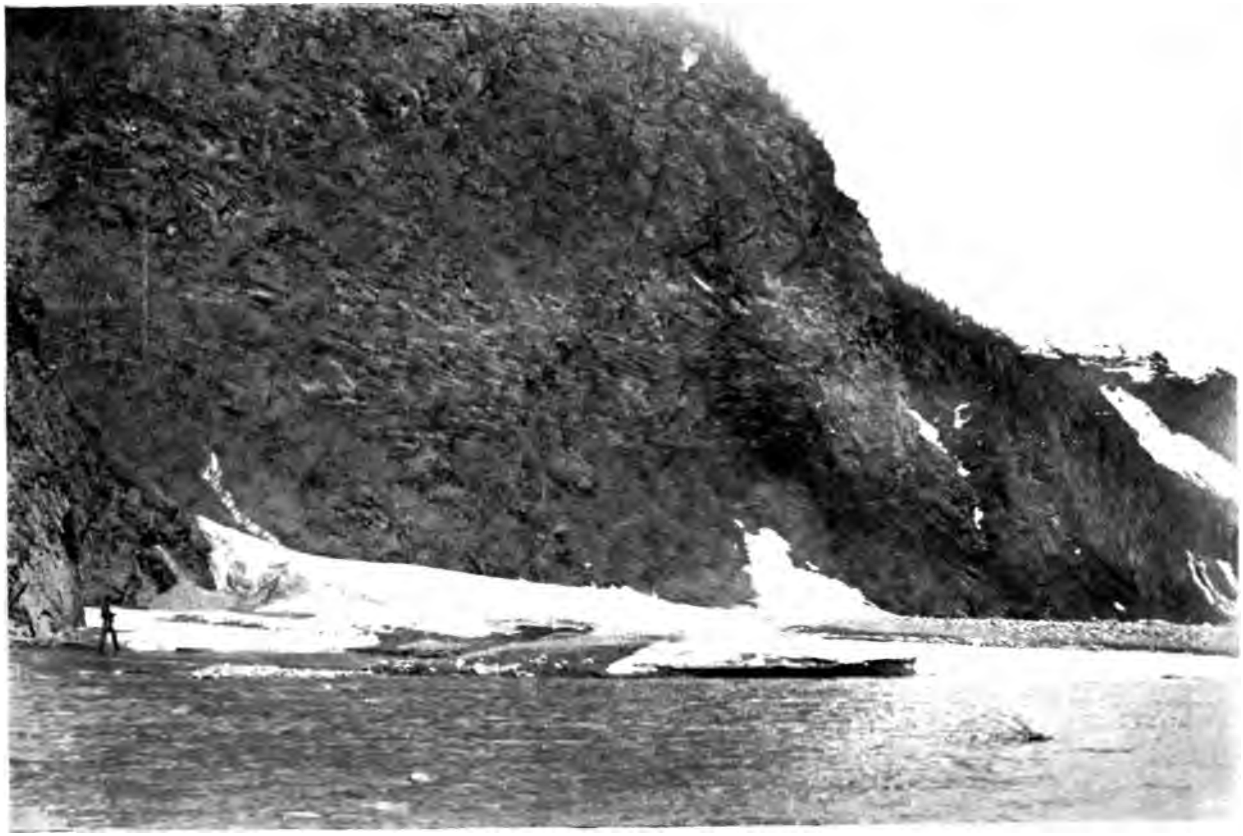
The road is shown on the left side.



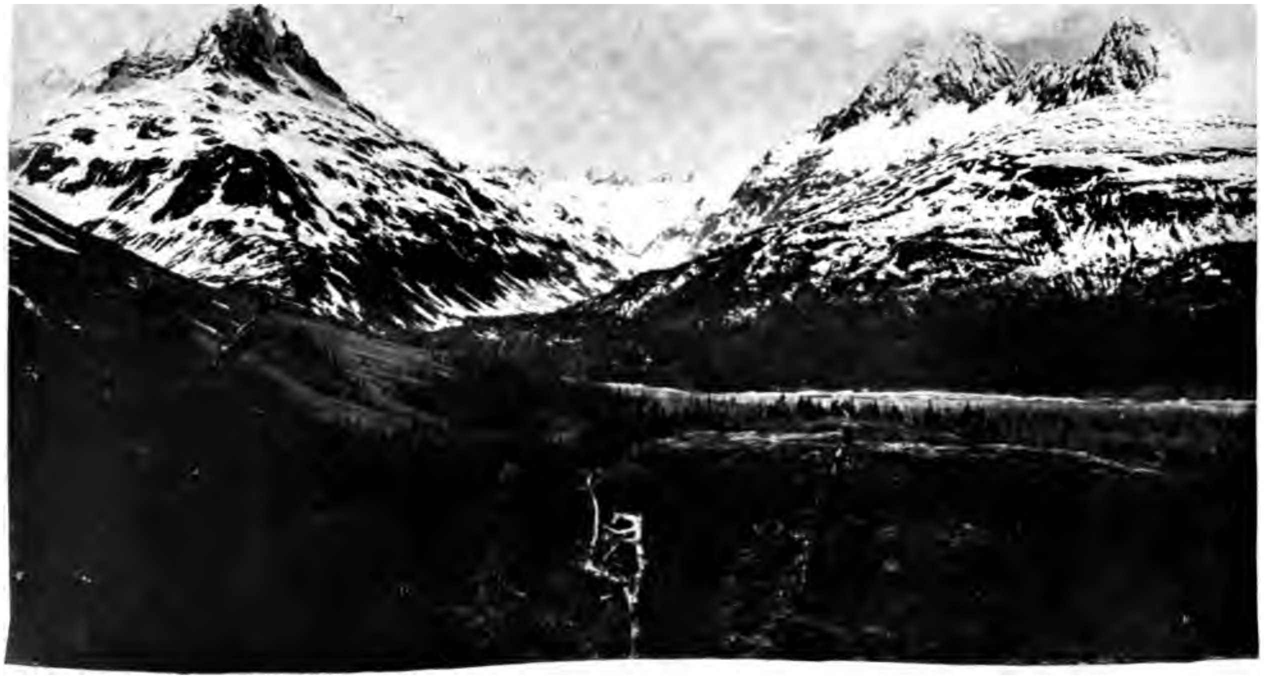
41.—LOOKING DOWN DUTCH FLAT TOWARD THE NORTH ENTRANCE TO KEYSTONE CANYON, SHOWING THE ROAD ALONG THE MOUNTAIN SIDE. JULY 4, 1899.



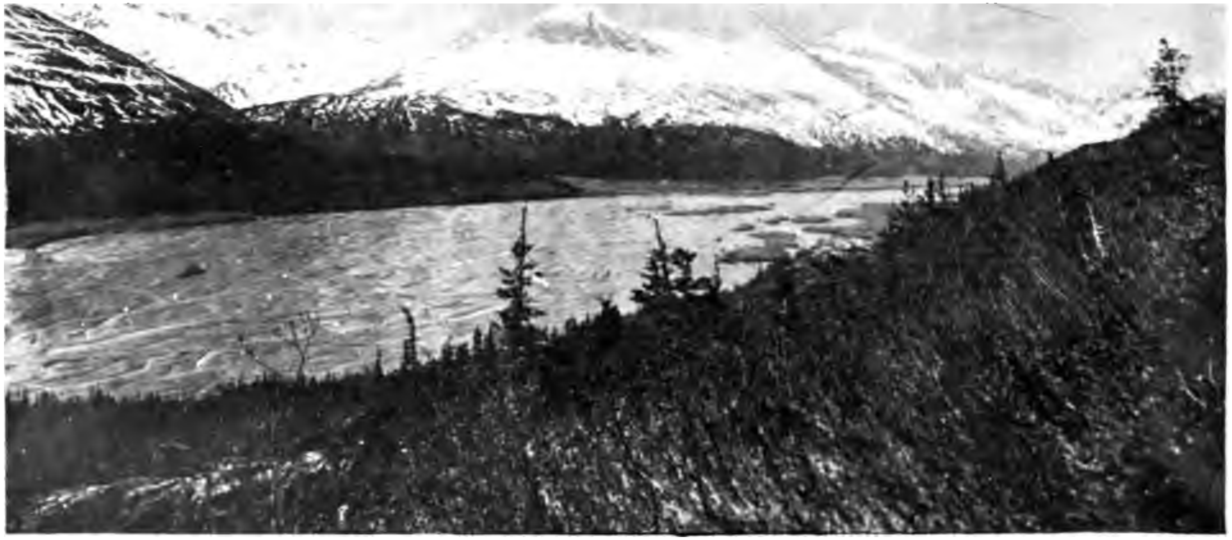
42.—NEAR NORTH END OF KEYSTONE CANYON, LOOKING SOUTH. MAY 15, 1899.



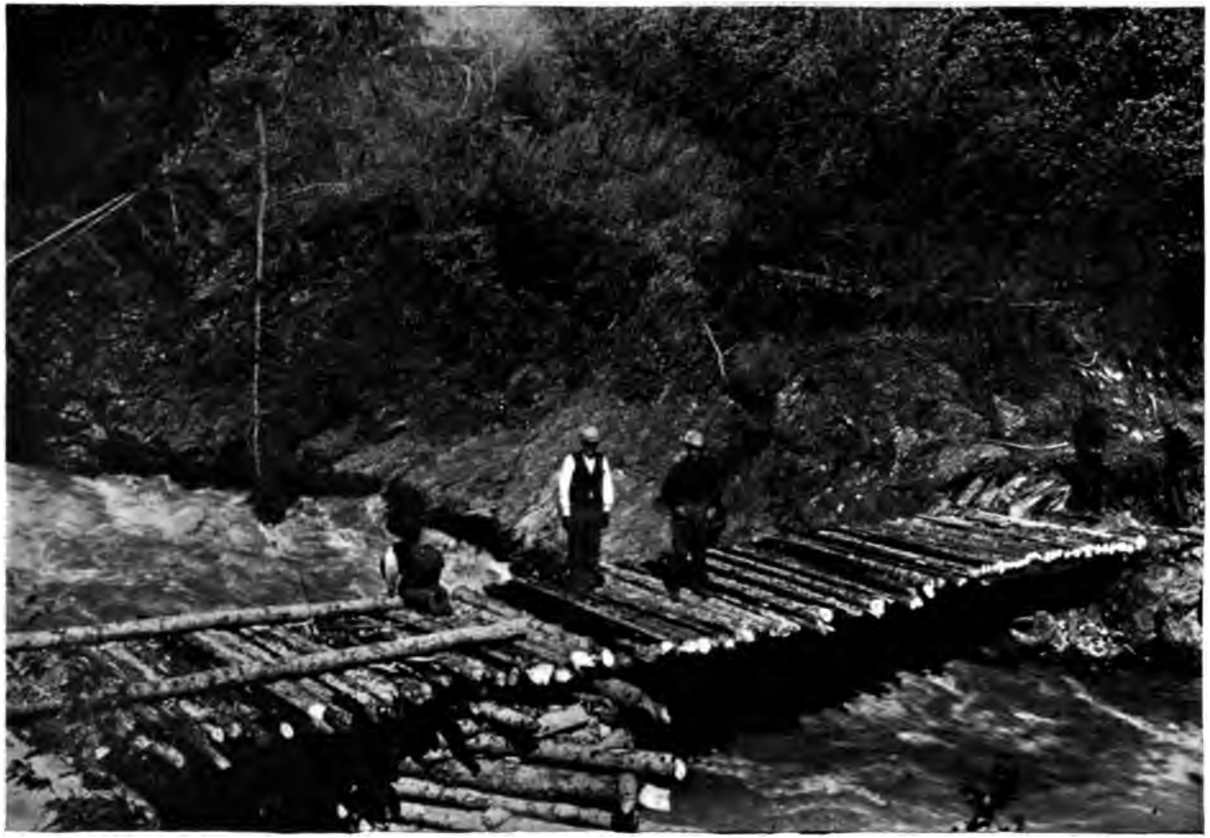
43.—JUST INSIDE SOUTHERN ENTRANCE TO KEYSTONE CANYON. MAY 12, 1899.



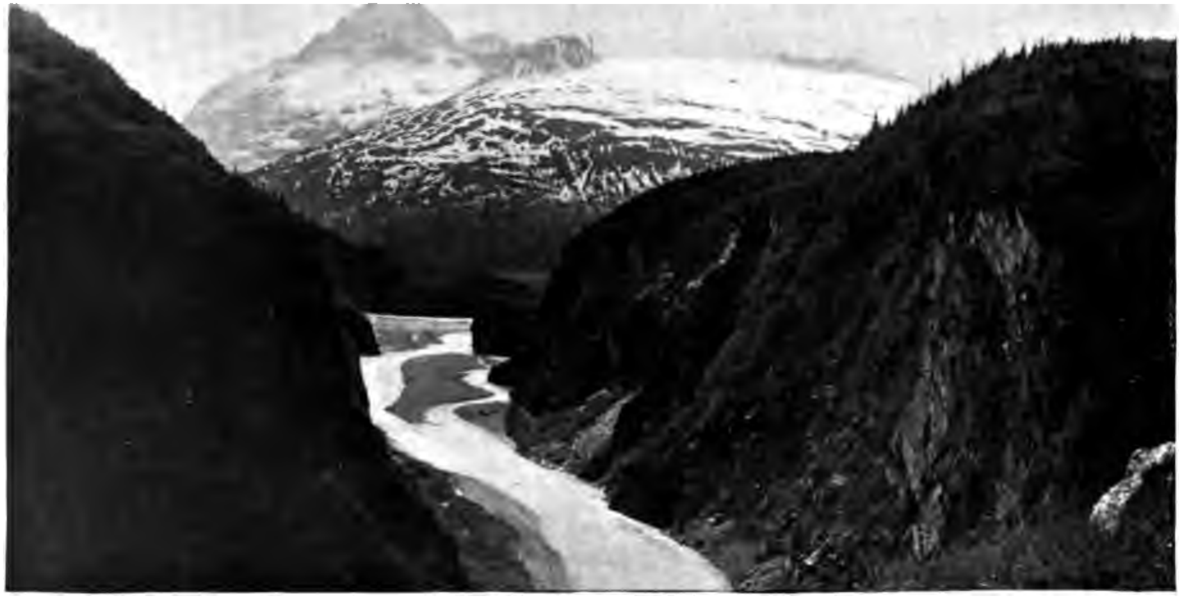
44.--LOOKING SOUTH FROM RIDGE NORTH OF STATION NO. 2; TYPICAL COAST RANGE MOUNTAINS; MOUNT BABCOCK ON LEFT. JUNE 9, 1899.



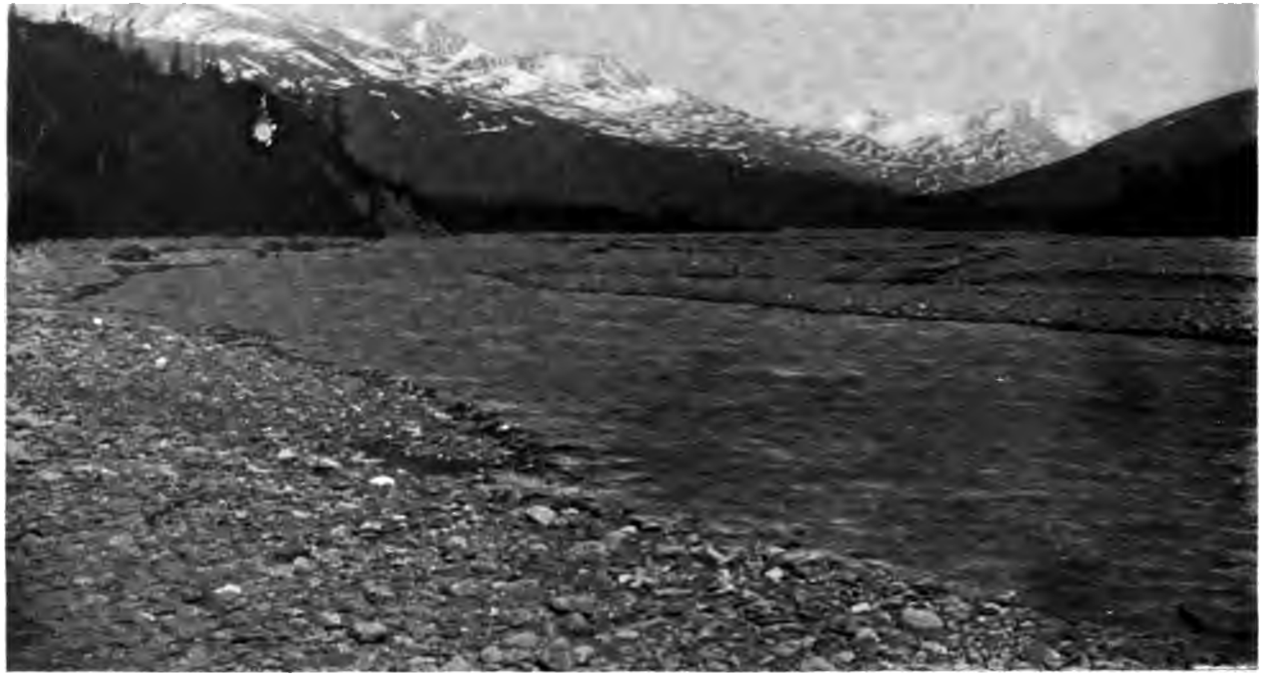
45.—LOOKING DOWN LOWE RIVER FLOOD PLAIN FROM RIDGE NORTH OF STATION NO. 2, SHOWING THE MANY CHANNELS OF THE RIVER. JUNE 9, 1899.



46.—BRIDGE OVER STREAM FROM CORBIN GLACIER. CAPTAIN ABERCROMBIE AND FOREMAN HOLLAND ON BRIDGE. JULY 6, 1899.

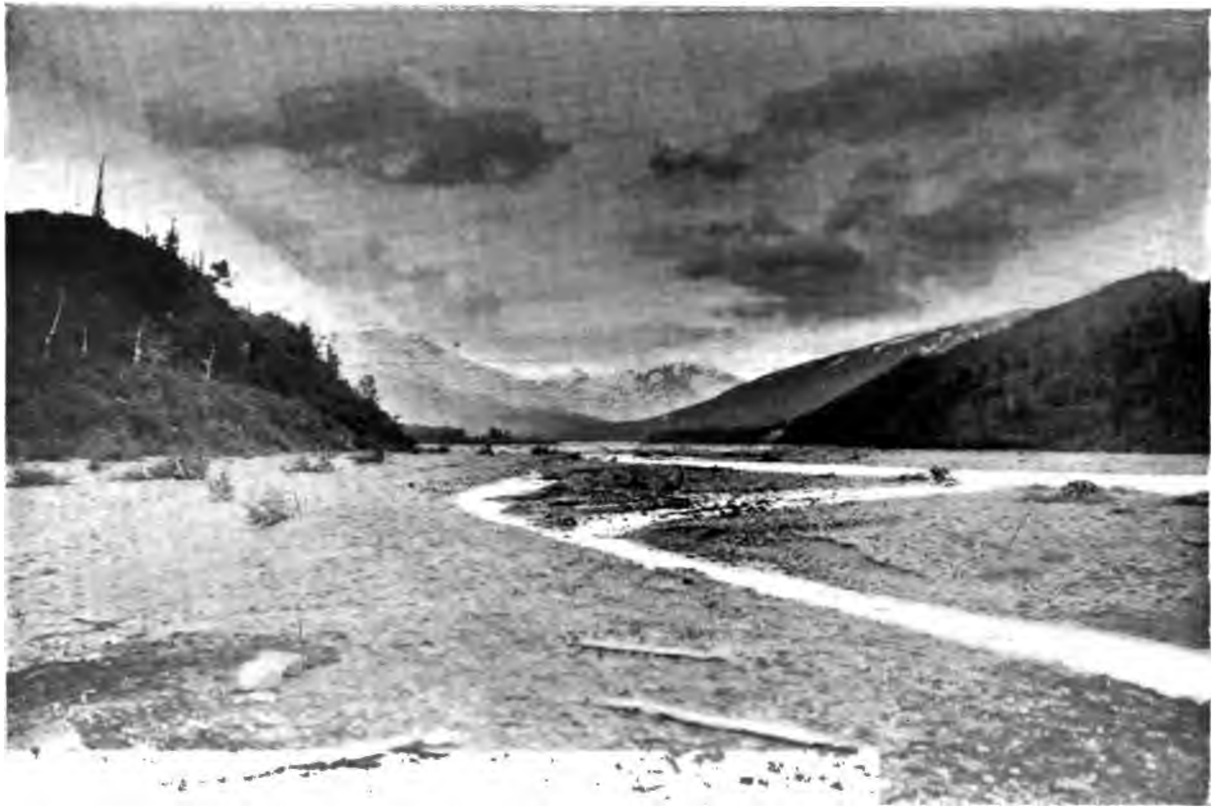


47.—KEYSTONE CANYON, LOOKING SOUTH, SHOWING ENTRANCE. JUNE 10, 1899.



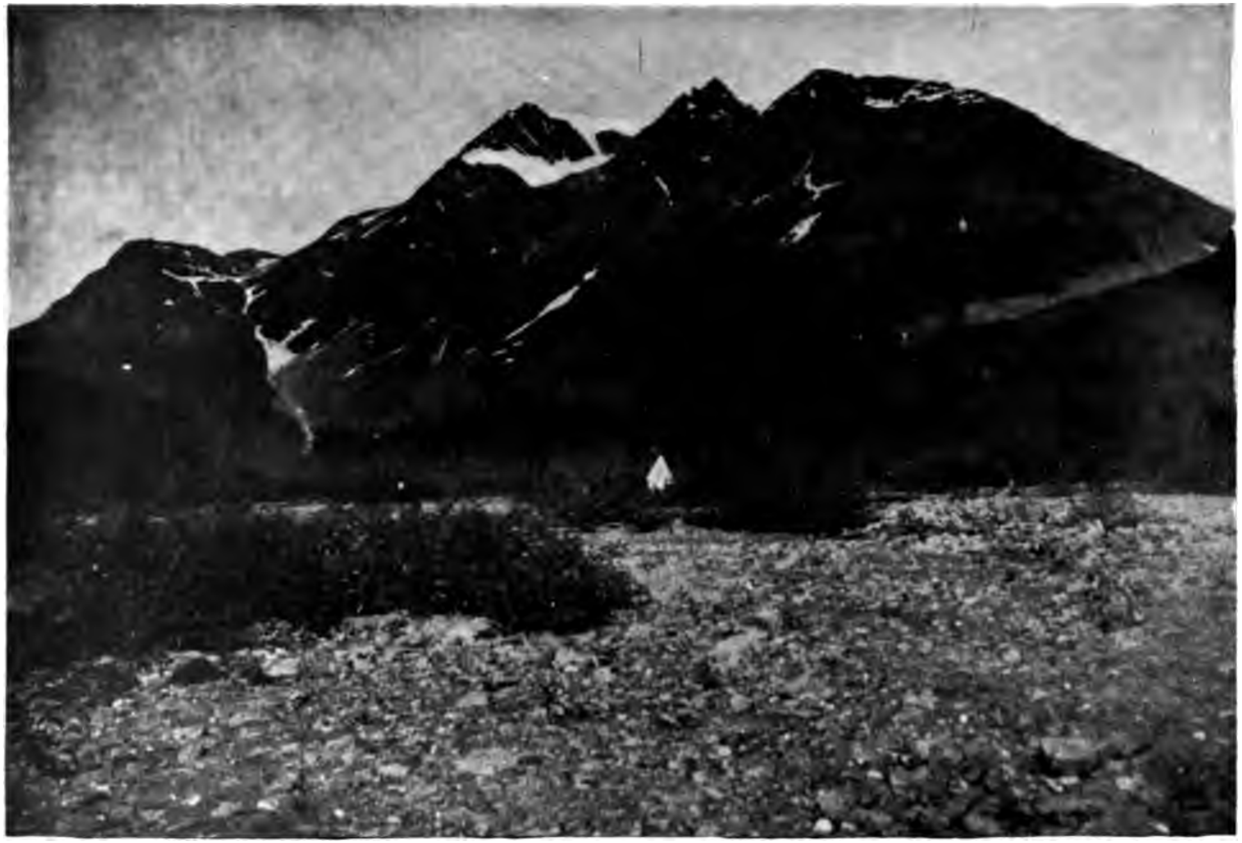
48.—LOOKING UP DUTCH FLAT; LOWE RIVER IN FOREGROUND. JULY 4, 1899.

Thompson Pass is immediately to the left of the first peak on left of picture.



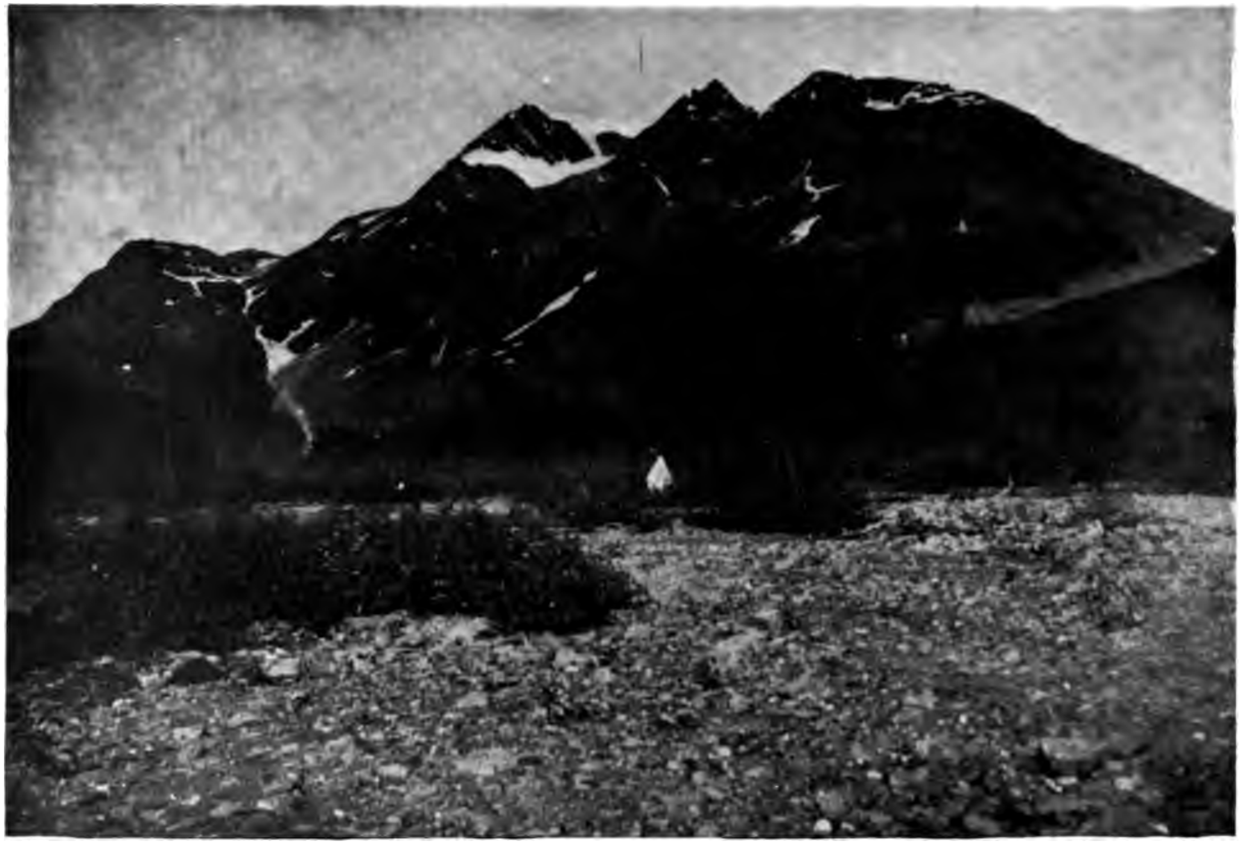
49.—LOOKING UP DUTCH FLAT FROM POINT NEAR CONSTRUCTION CAMP NO. 3; A SMALL BRANCH OF LOWE RIVER IN THE FOREGROUND. JULY 4, 1899.

It is just beyond the timbered mound on the left that the stream from Corbin Glacier empties into Lowe River.



50.—MOUNTAINS AT THE WEST END OF DUTCH FLAT. JULY 25, 1899.

The east end of Hogback Glacier is seen on the summit; canyon of Corbin Glacier stream on the right.



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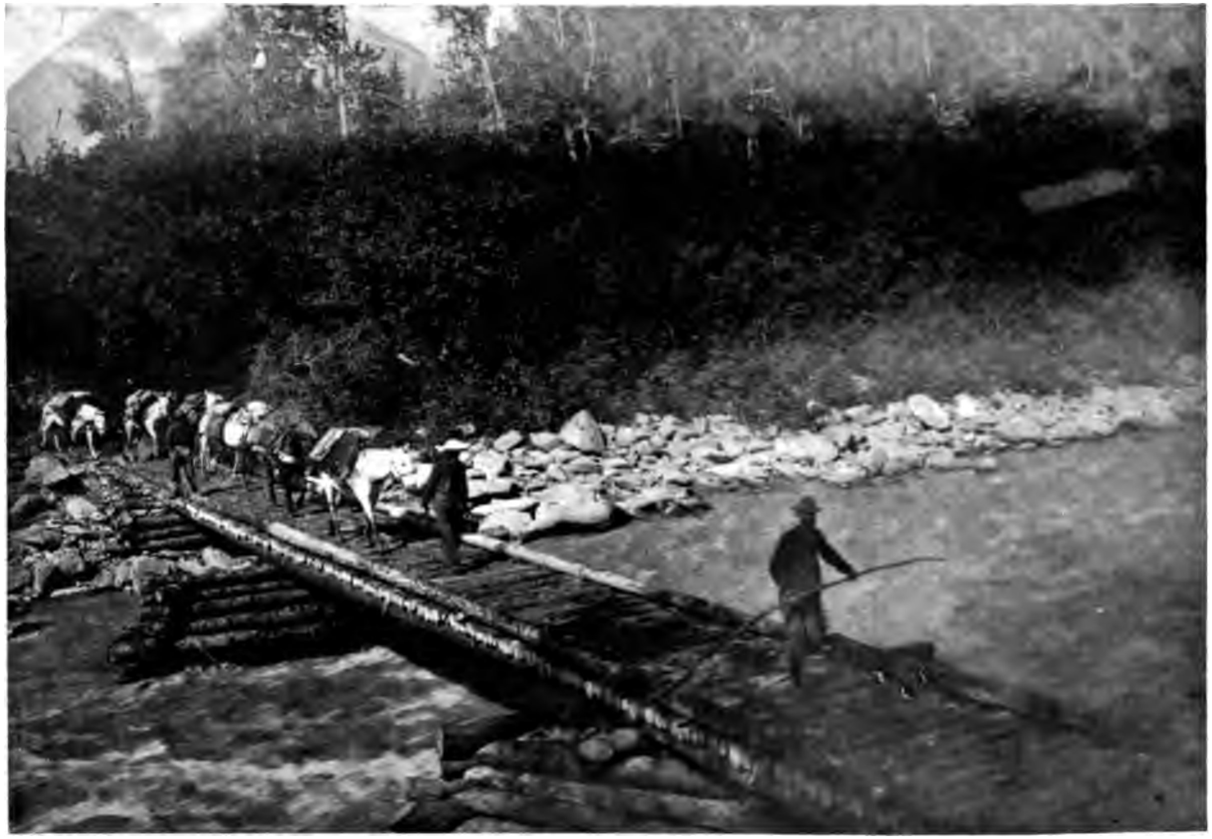
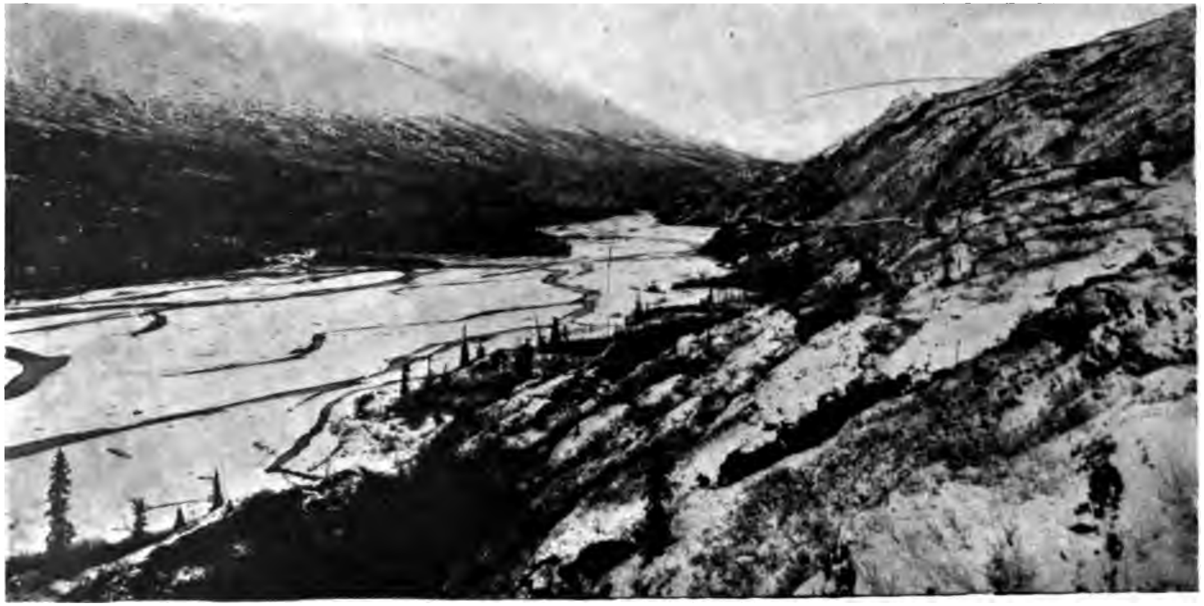
The east end of Hogback Glacier is seen on the summit; canyon of Corbin Glacier stream on the right.

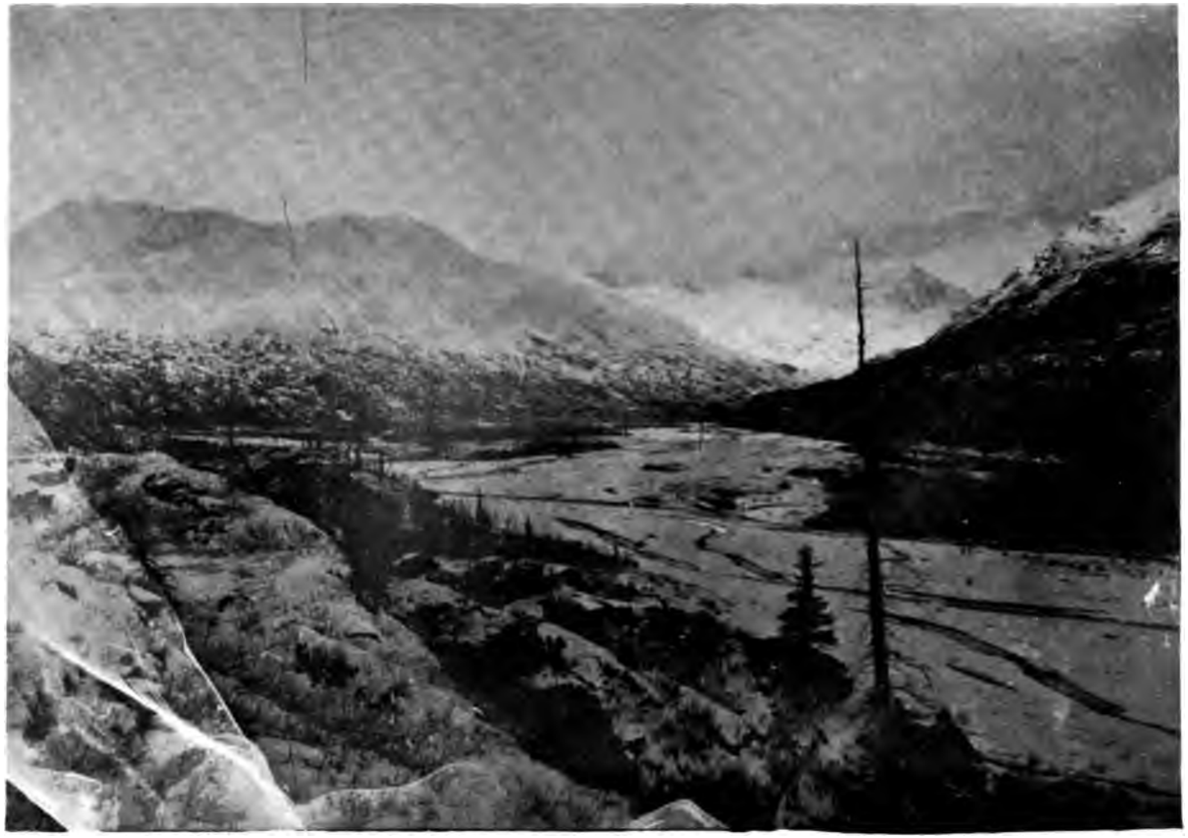


52.—BRIDGE OVER SECOND GLACIER STREAM EMPTYING INTO LOWE RIVER ALONG DUTCH FLAT. FROM THE EAST BANK. PACK TRAIN MOVING THE CONSTRUCTION CAMP. JULY 21, 1899.

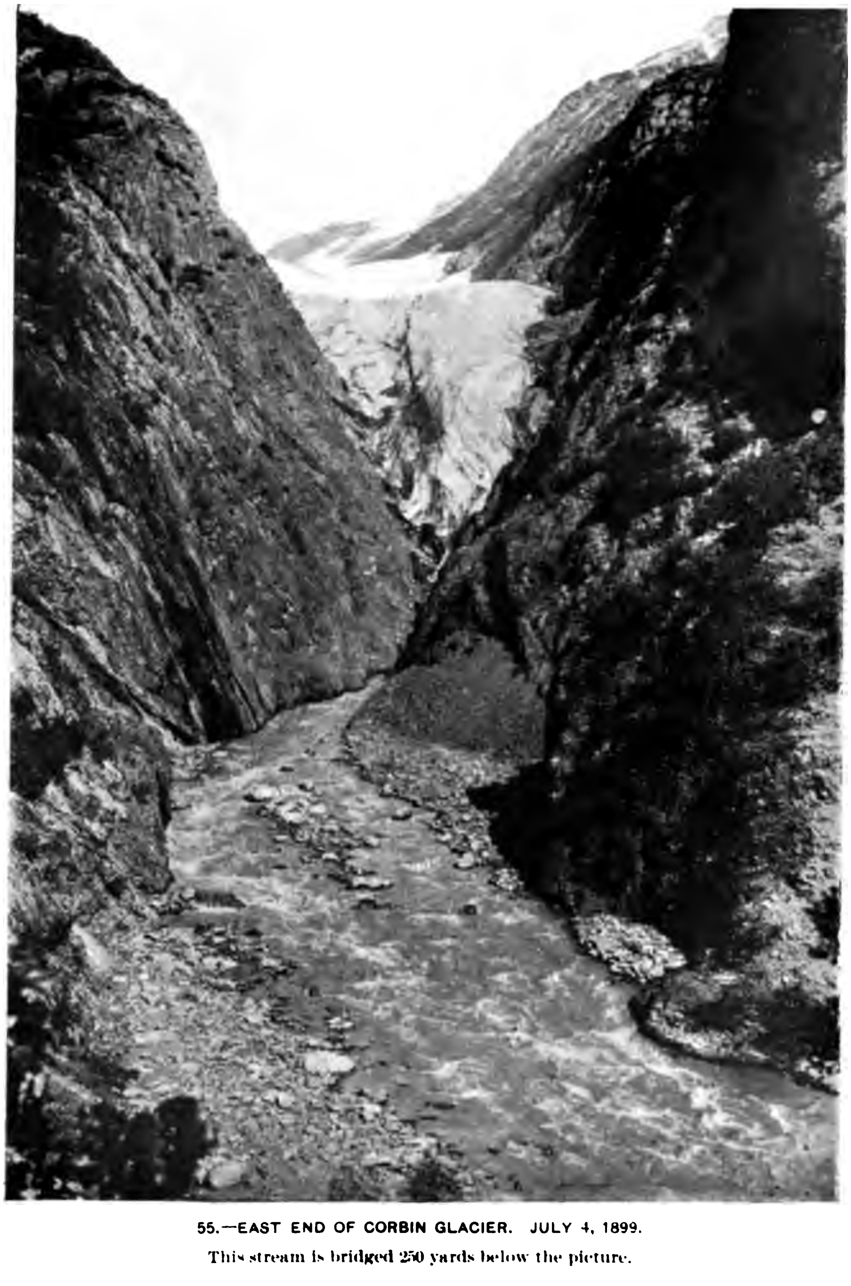
This bridge is 112 feet long.



53. LOOKING DOWN THE CHENA FROM A POINT 2 MILES ABOVE STATION NO. 3. SHOWING MILITARY ROAD ALONG THE SIDEHILLS ON THE RIGHT. OCTOBER, 1899.

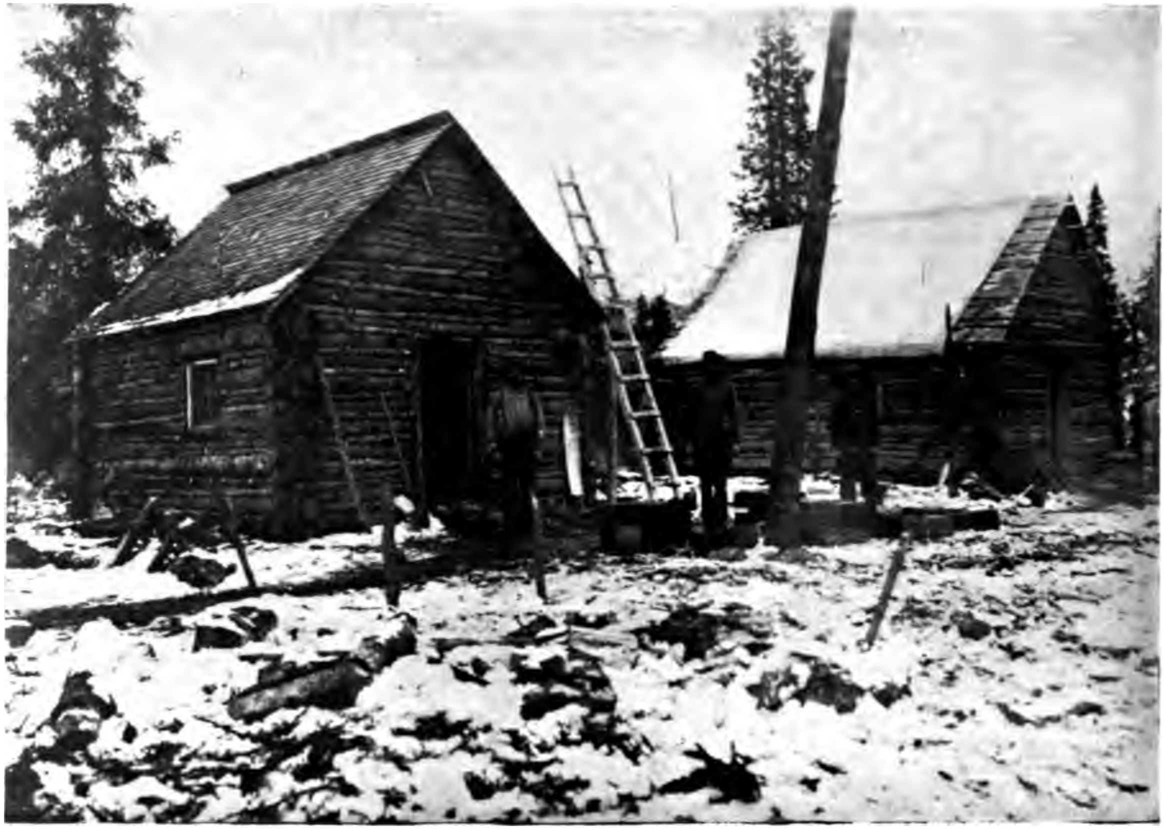


54.—LOOKING UP THE CHENA FROM A POINT 2 MILES ABOVE STATION NO. 3. PTARMIGAN CREEK COMES IN FROM THE LEFT IN MIDDLE DISTANCE. OCTOBER 8, 1899.

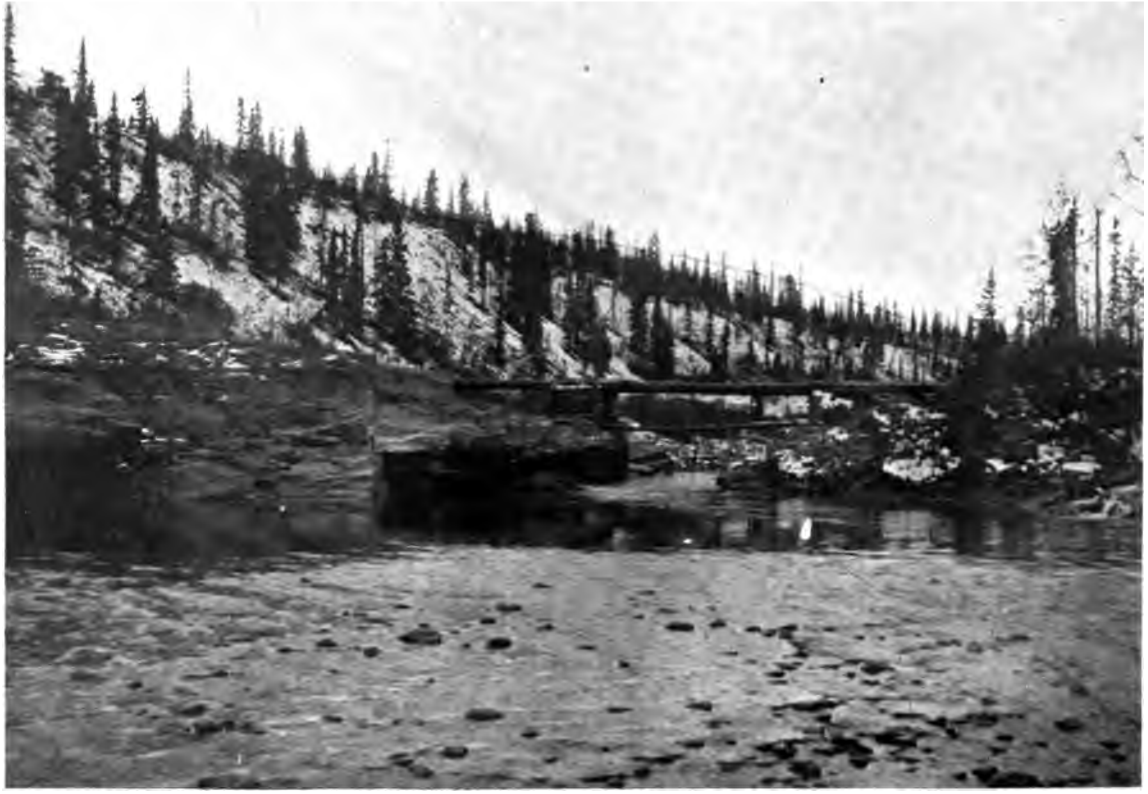


55.—EAST END OF CORBIN GLACIER. JULY 4, 1899.

This stream is bridged 250 yards below the picture.

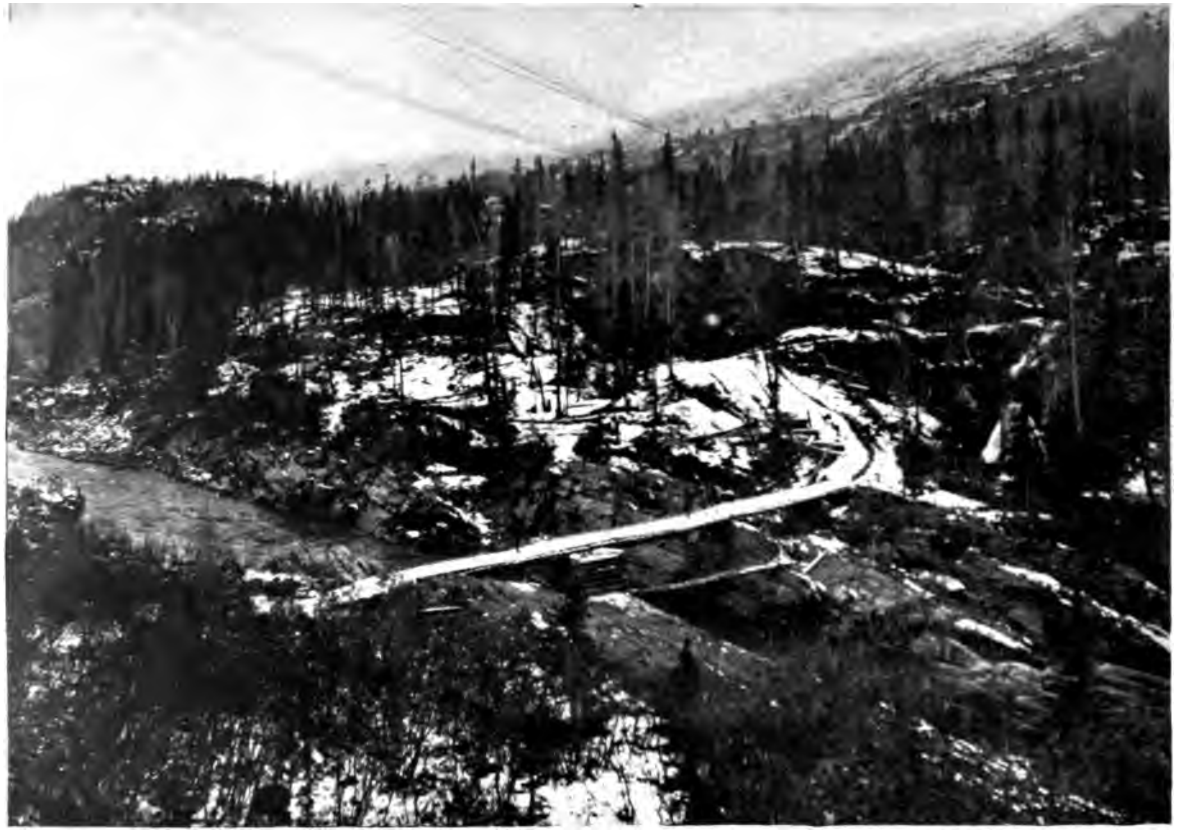


56.—STATION NO. 3 ON TRANS-ALASKAN MILITARY ROAD ON CHENA RIVER, 10 MILES FROM THOMPSON PASS. OCTOBER, 1899.



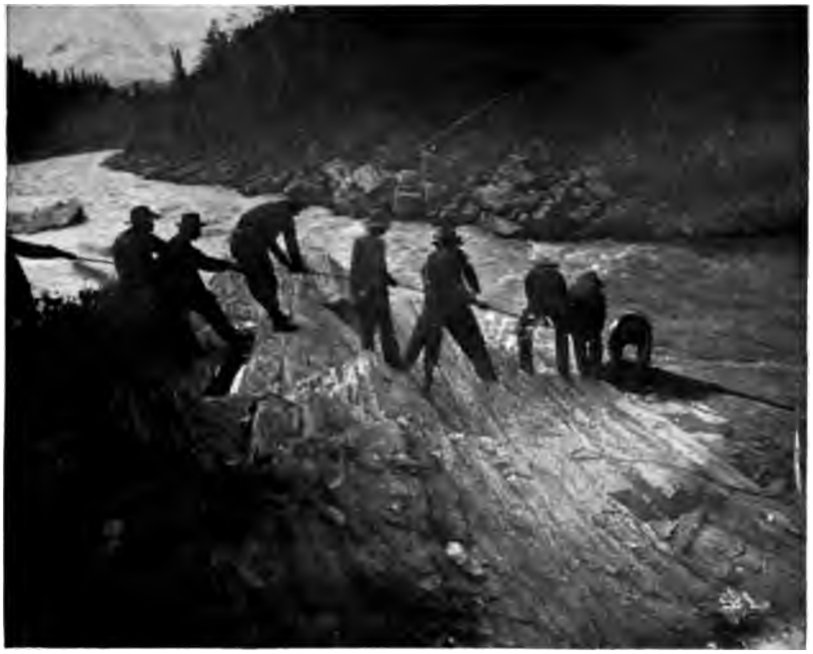
57.—BRIDGE OVER CHENA RIVER, 121 FEET LONG. OCTOBER, 1899.

The foot log beneath the bridge was washed away during high water in August.

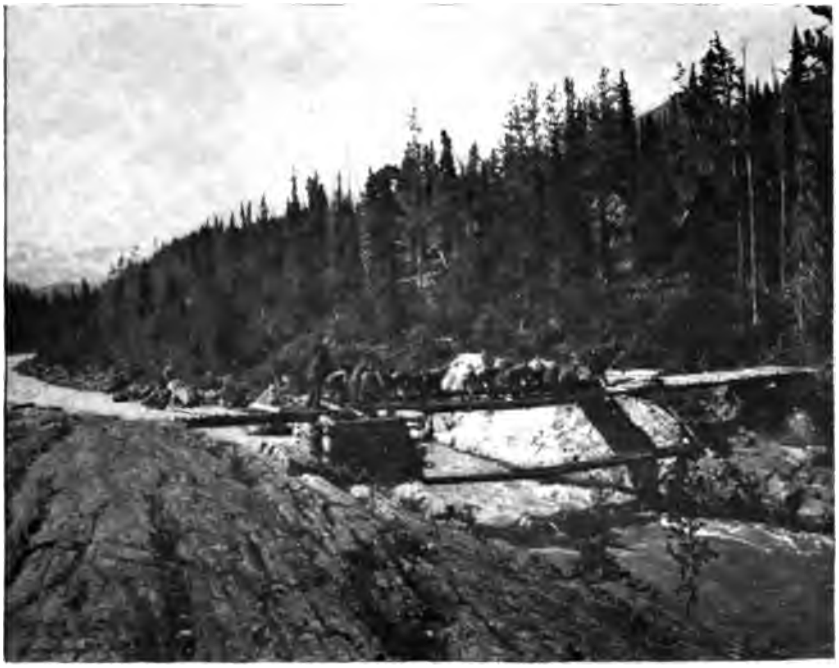


58.—BRIDGE OVER CHENA RIVER, 121 FEET LONG. OCTOBER, 1899.

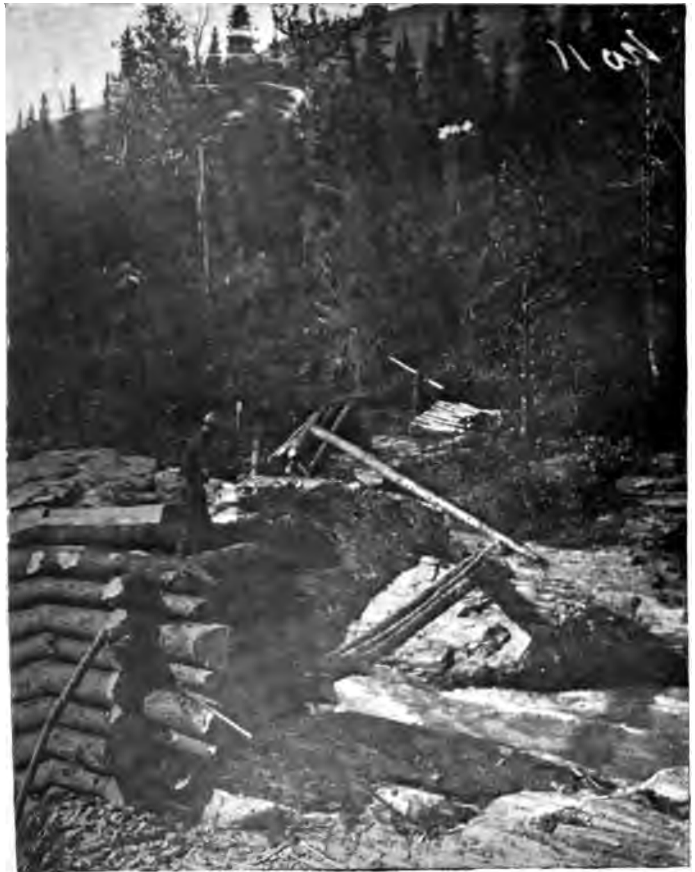
The foot log beneath the bridge was washed away during high water in August.



59.—HAULING LOGS OUT OF CHENA FOR BRIDGE. AUGUST, 1899.

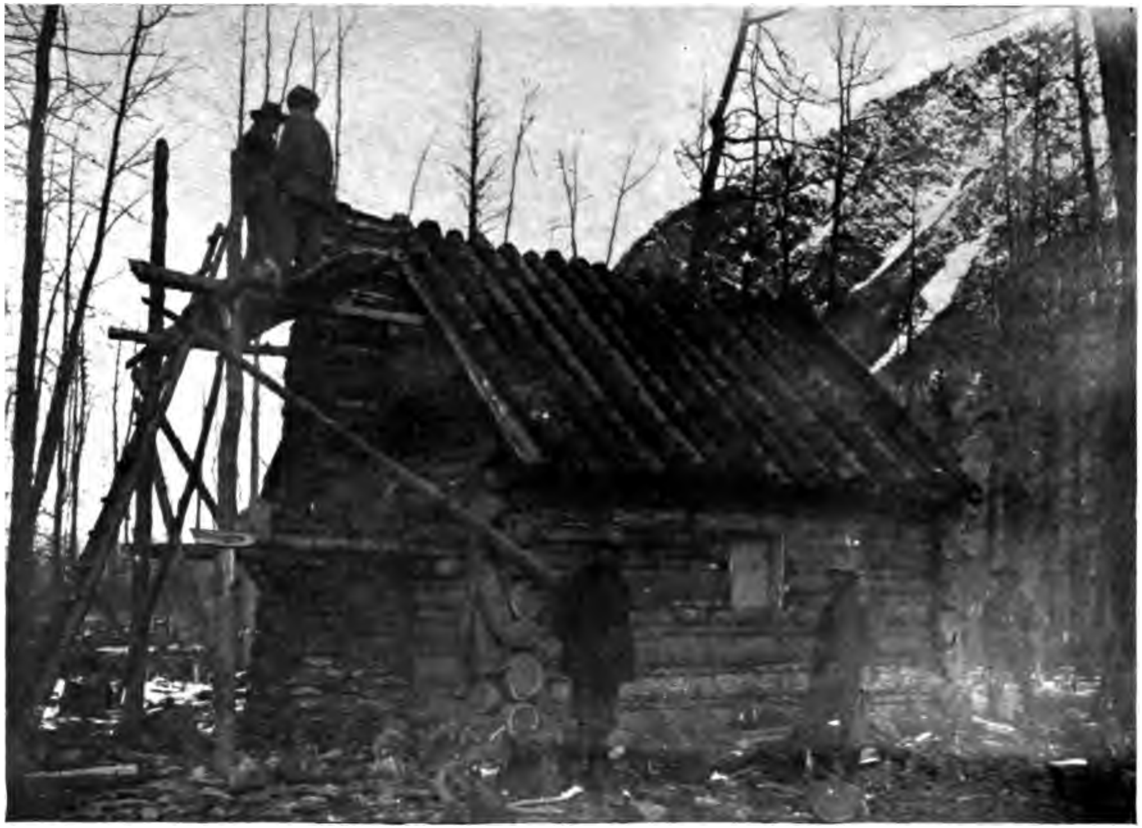


60.—PLACING STRINGERS IN POSITION ON BRIDGE ABUTMENTS OVER CHENA RIVER. AUGUST, 1899.



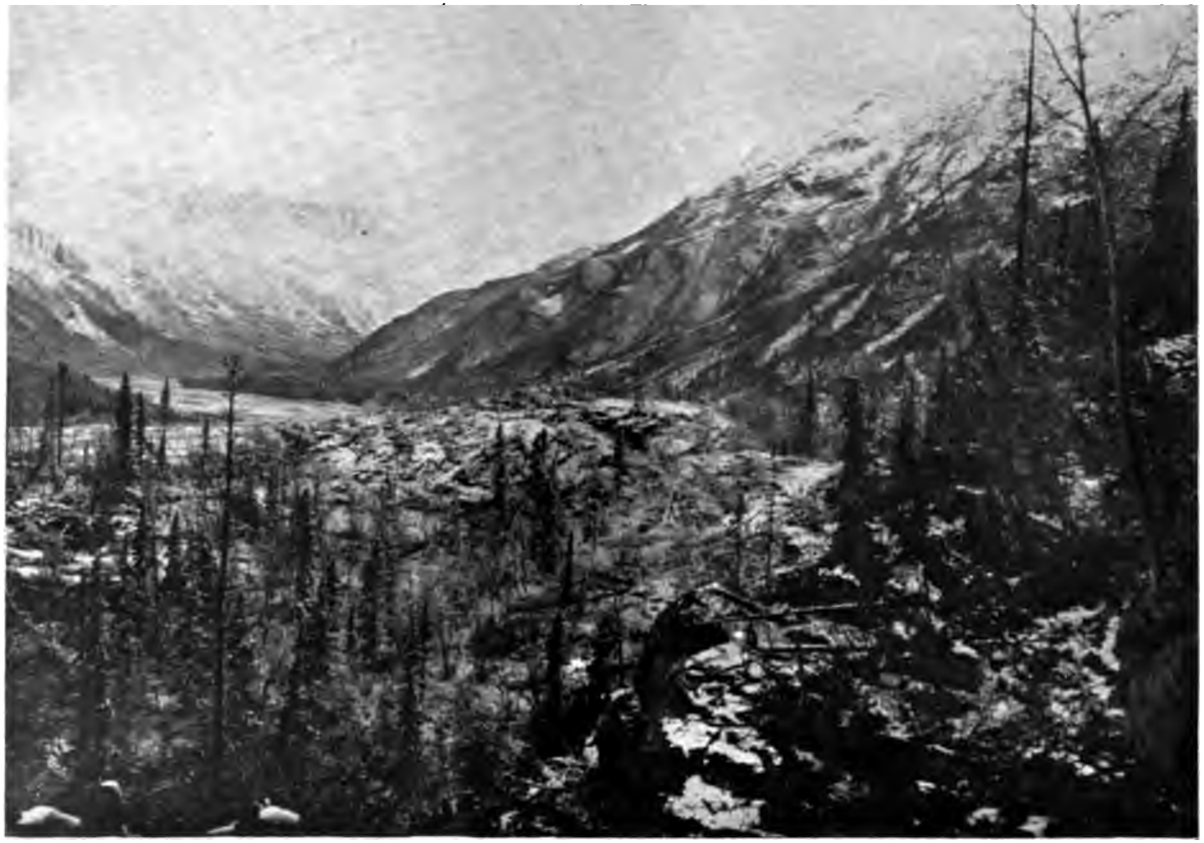
61.—BUILDING CRIBS FOR ABUTMENT OF BRIDGE OVER CHENA RIVER.
AUGUST, 1899.

62.—SAME AS NO. 61.



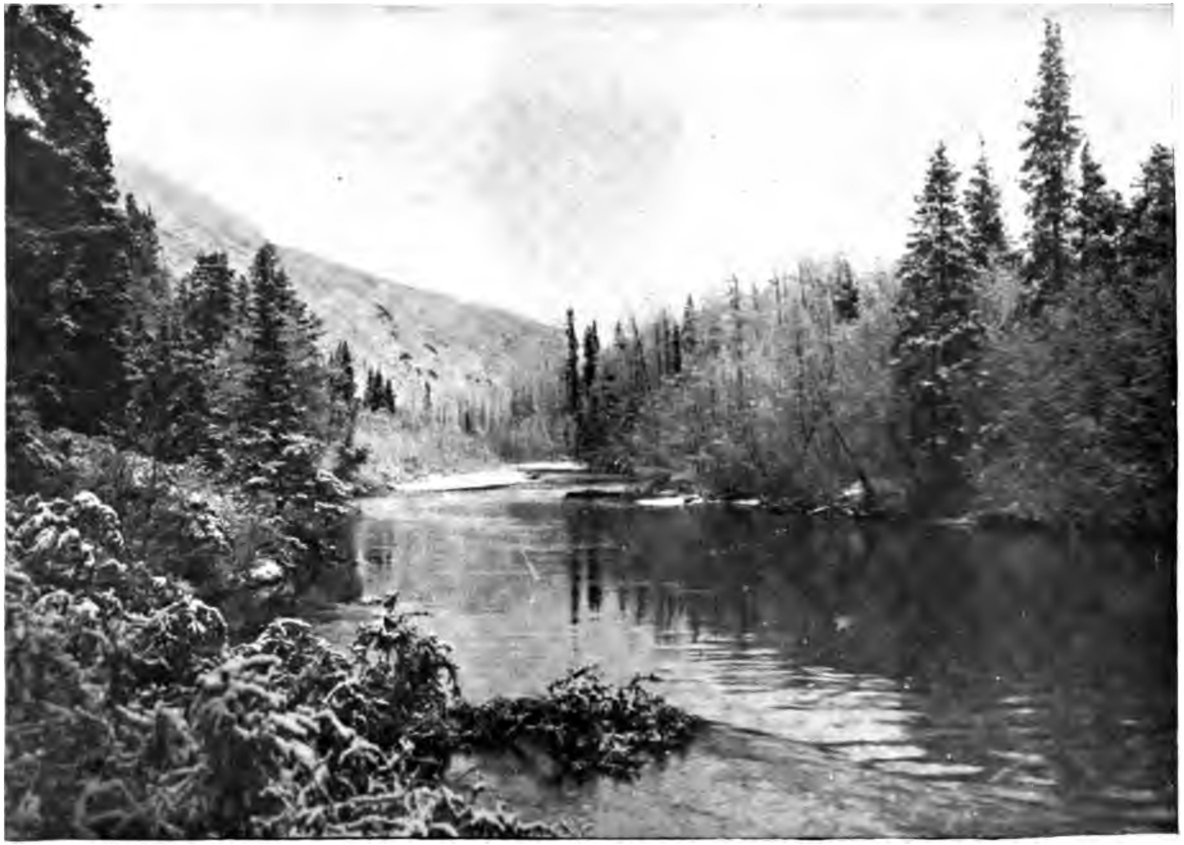
63.—RELIEF CABIN ON CHENA RIVER. OCTOBER, 1899.

This cabin has a fireplace and Arkansas chimney.



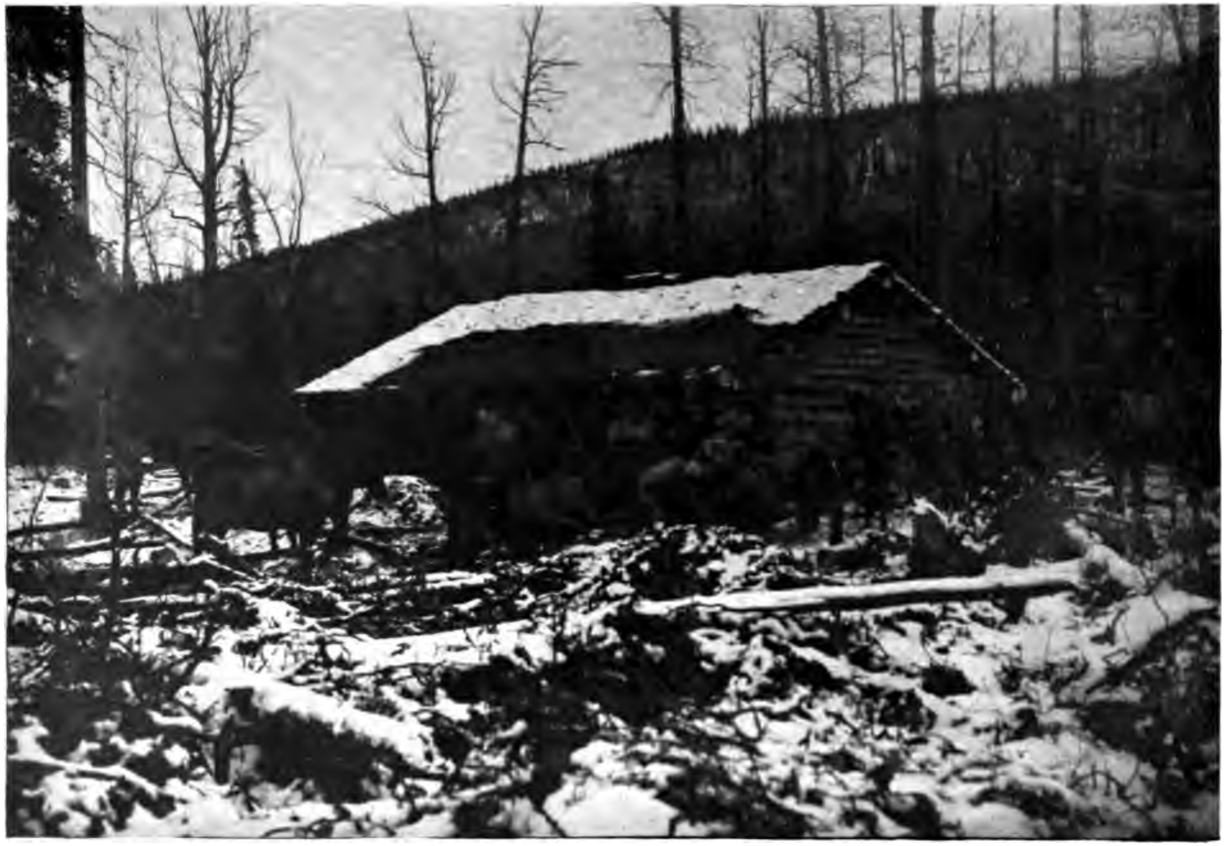
64.—LOOKING UP THE CHENA FROM THE STEWART CREEK DIVIDE, SHOWING TRAIL IN FOREGROUND. OCTOBER 6, 1899.

65.—BRIDGE OVER STEWART CREEK. OCTOBER, 1899.

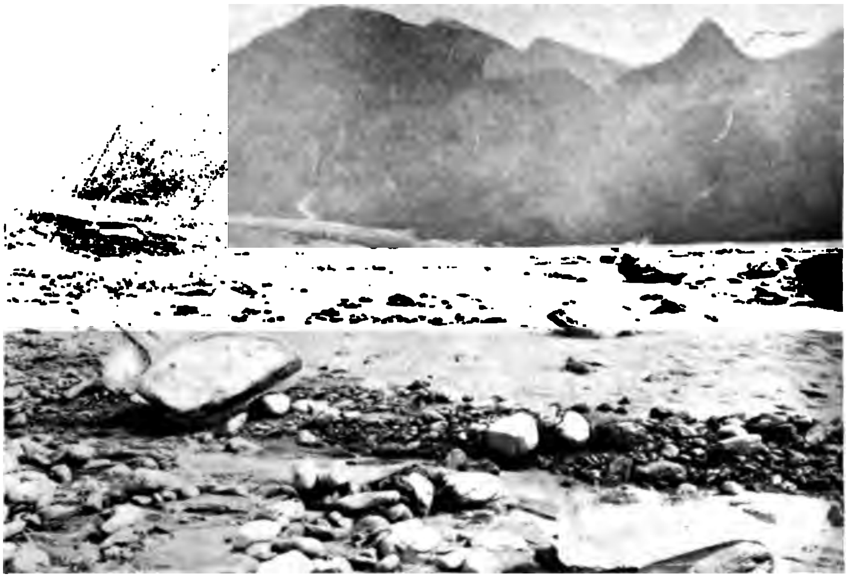


66.—ALONG THE KANATA BELOW BOULDER CREEK. OCTOBER 6, 1899.

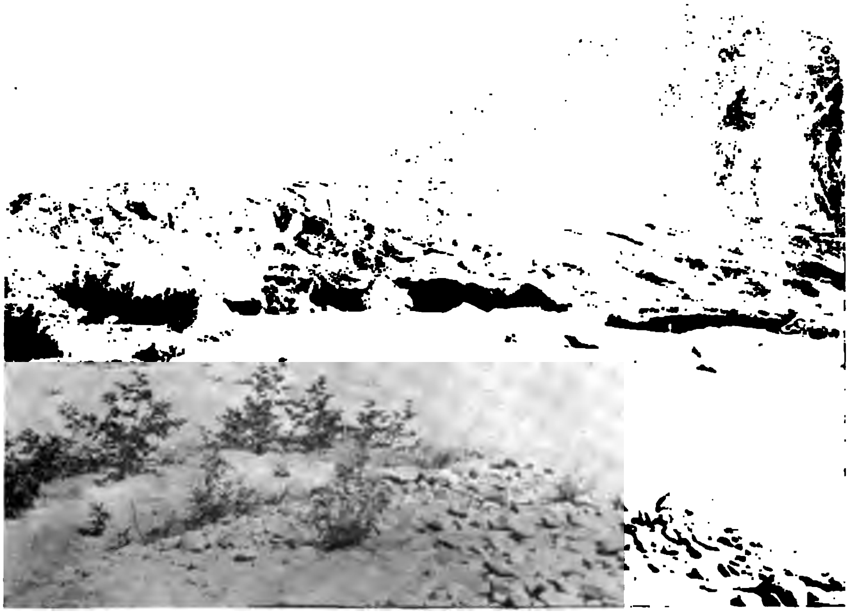
The road is through the timber and brush just to the left of the picture.



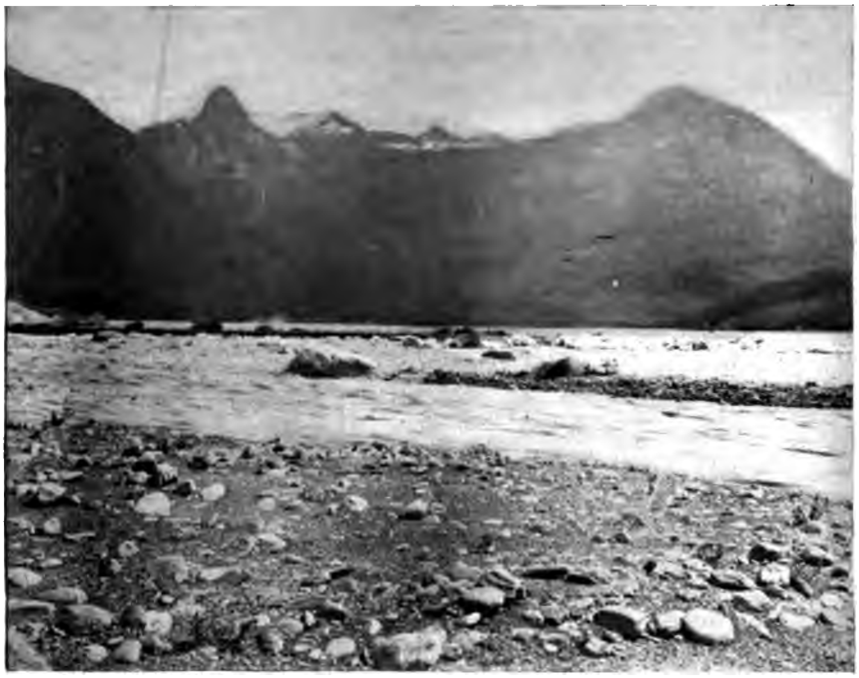
67. GOVERNMENT STABLES ON THE KANATA, WITH STALLS AND MANGERS FOR 14 HORSES. OCTOBER 5, 1899.



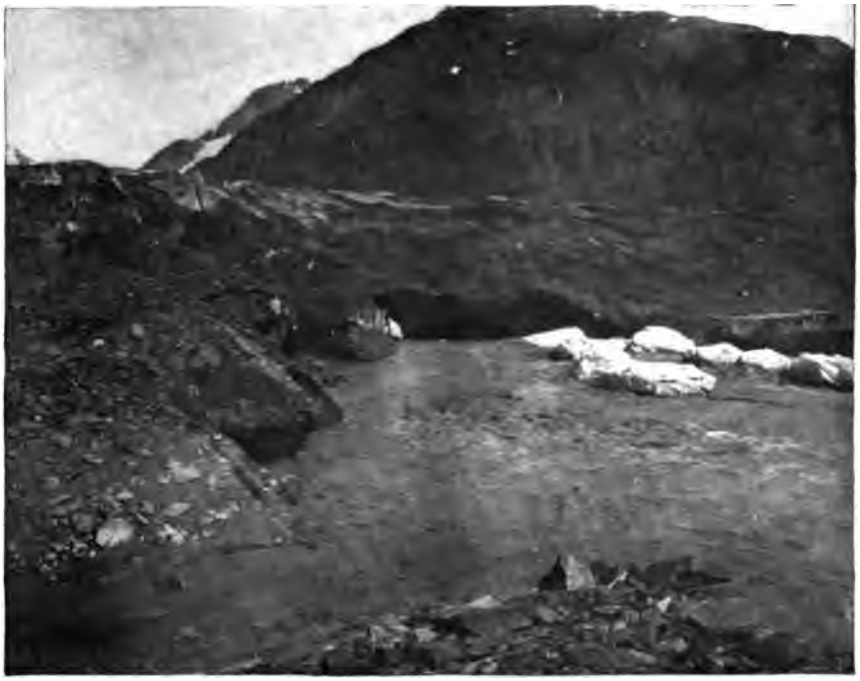
68.—STREAM FROM VALDEZ GLACIER. AUGUST 16, 1899.



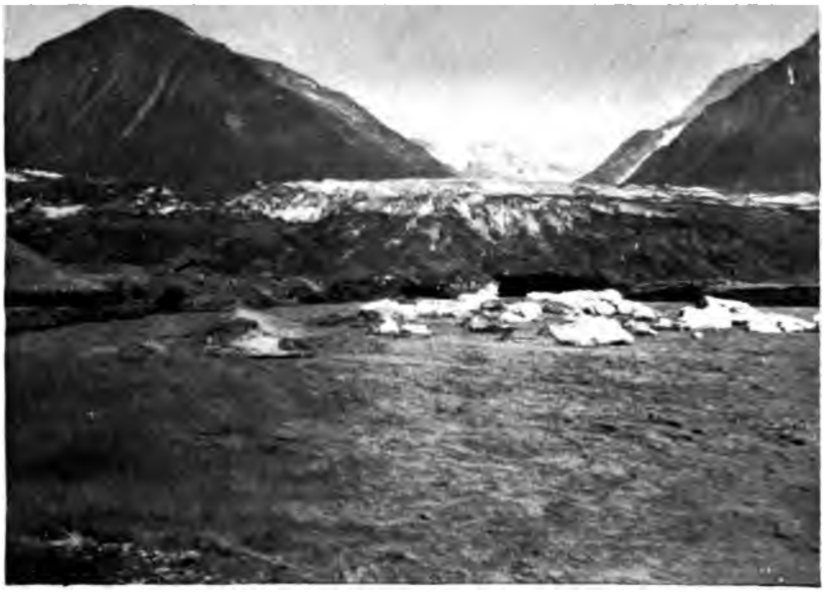
69.—SAME AS NO. 68.



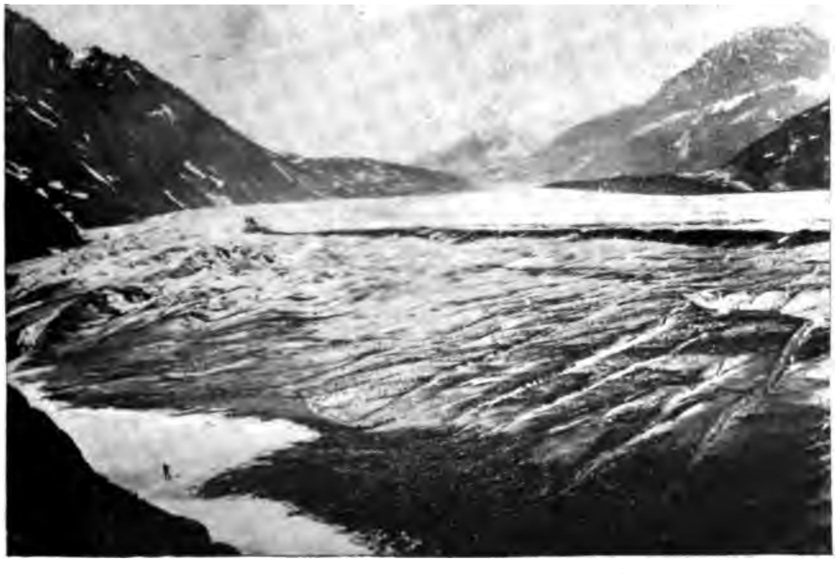
70.—FLOOD PLAIN OF VALDEZ GLACIER. AUGUST 16, 1899.



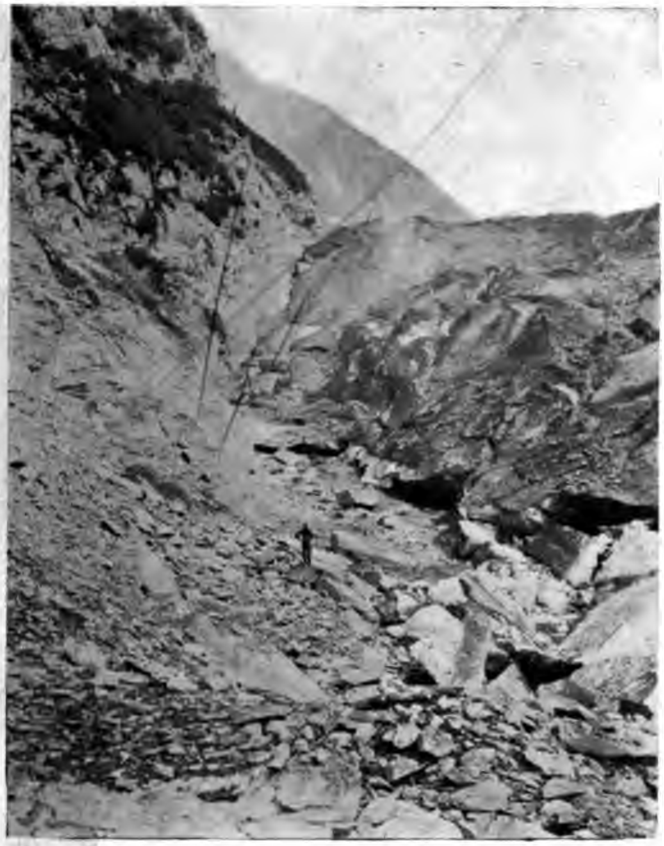
71.—VALDEZ GLACIER RIVER. AUGUST 16, 1899.



72.—EAST END OF VALDEZ GLACIER, SHOWING DRIFT ICE IN GLACIER RIVER TRAVERSING FLOOD PLAIN. AUGUST 16, 1899.



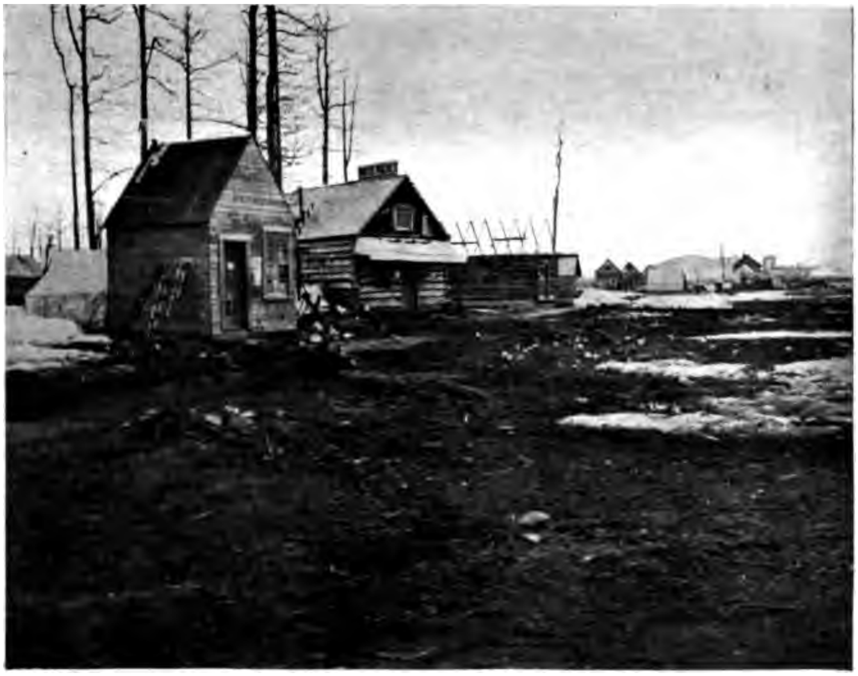
73.—THIRD BENCH OF VALDEZ GLACIER. AUGUST 16, 1899.



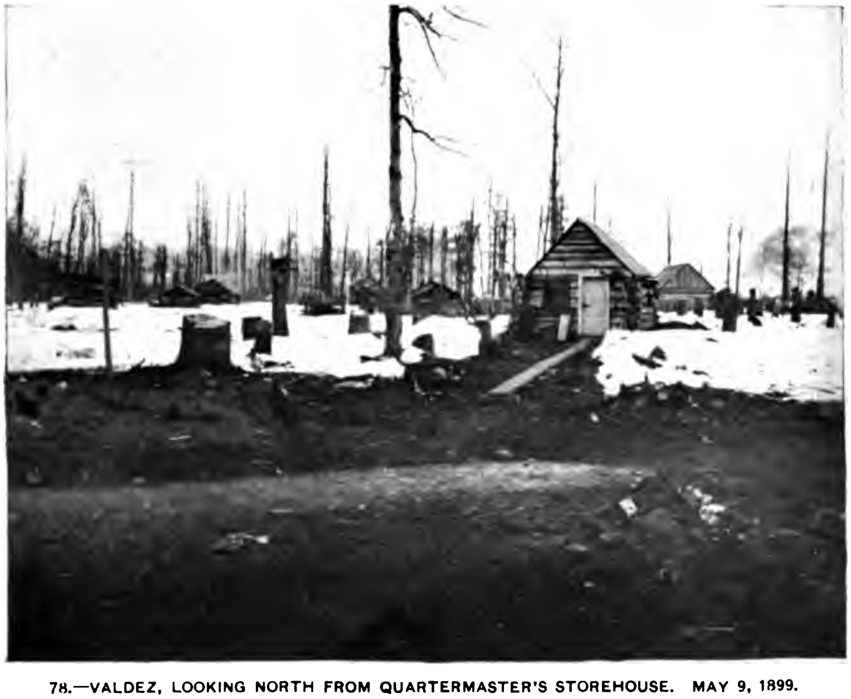
74.—AT THE SIDE OF VALDEZ GLACIER. AUGUST 16, 1899.

75.—VIEW OF VALDEZ FROM THE BAY. MAY 10, 1899.

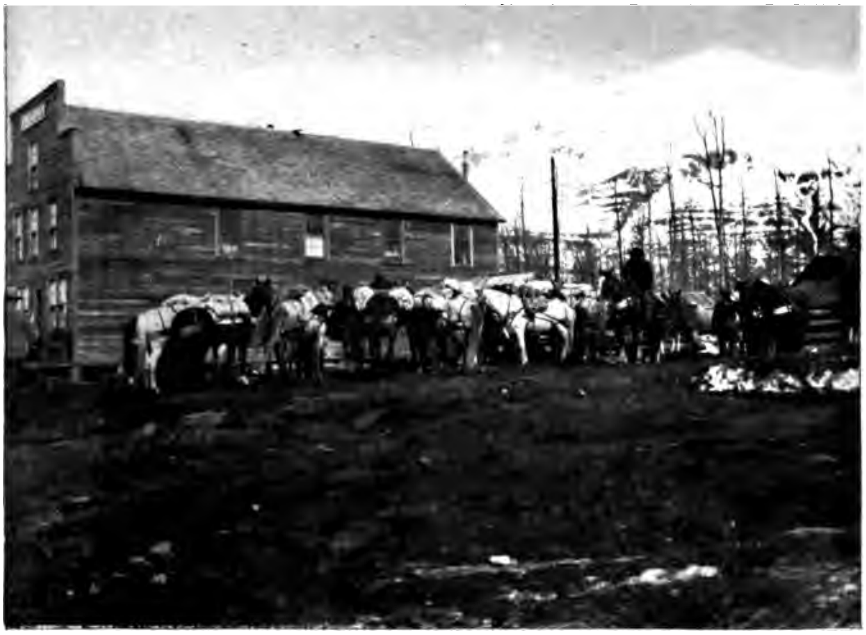
76.—LOOKING SOUTHEAST FROM VALDEZ. APRIL 29, 1899.



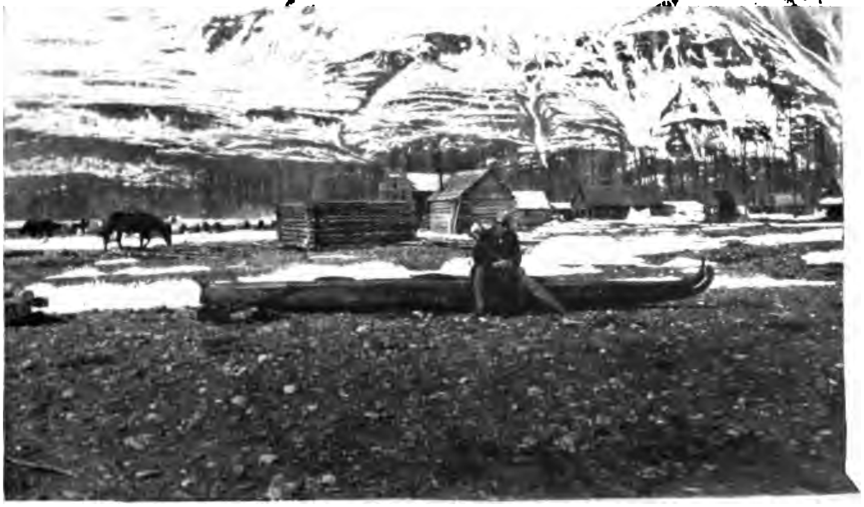
77. VALDEZ, LOOKING EAST FROM QUARTERMASTER'S STOREHOUSE. MAY 9, 1899.



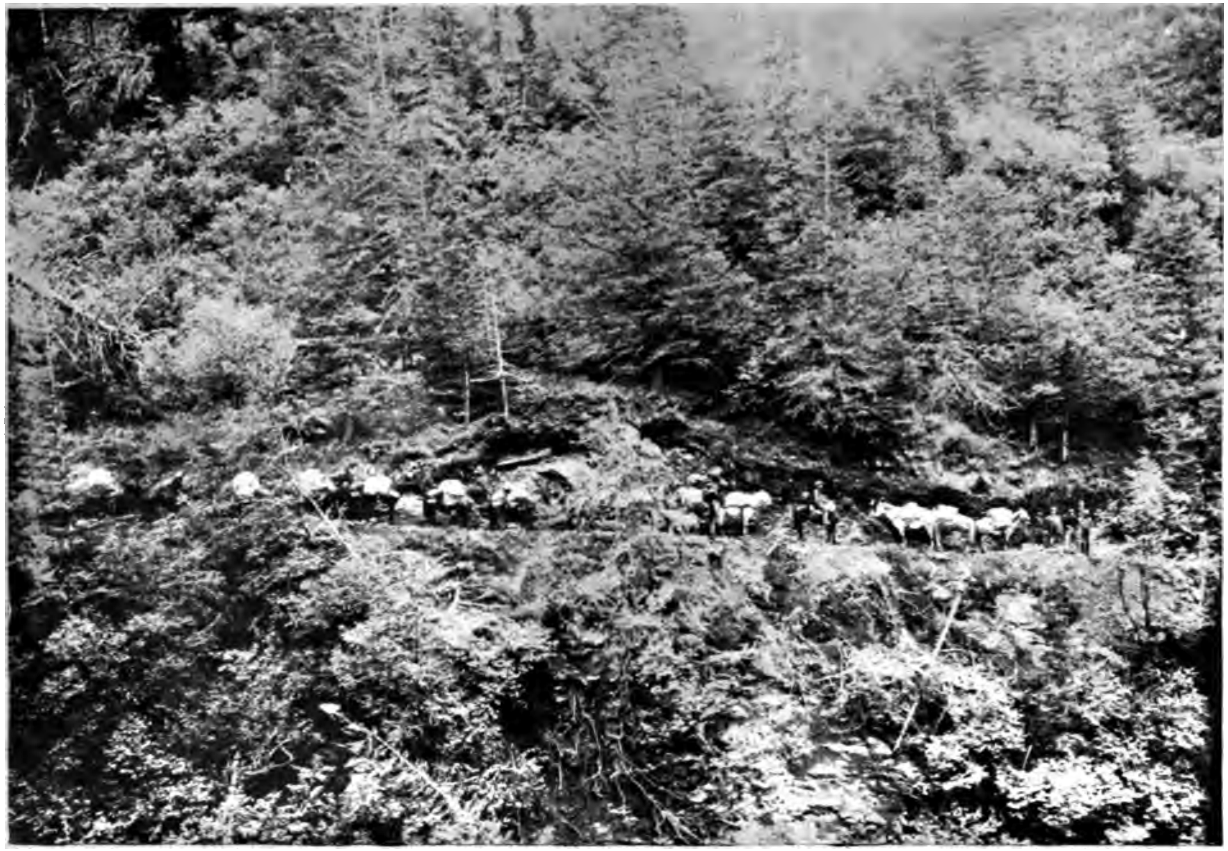
78.—VALDEZ, LOOKING NORTH FROM QUARTERMASTER'S STOREHOUSE. MAY 9, 1899.



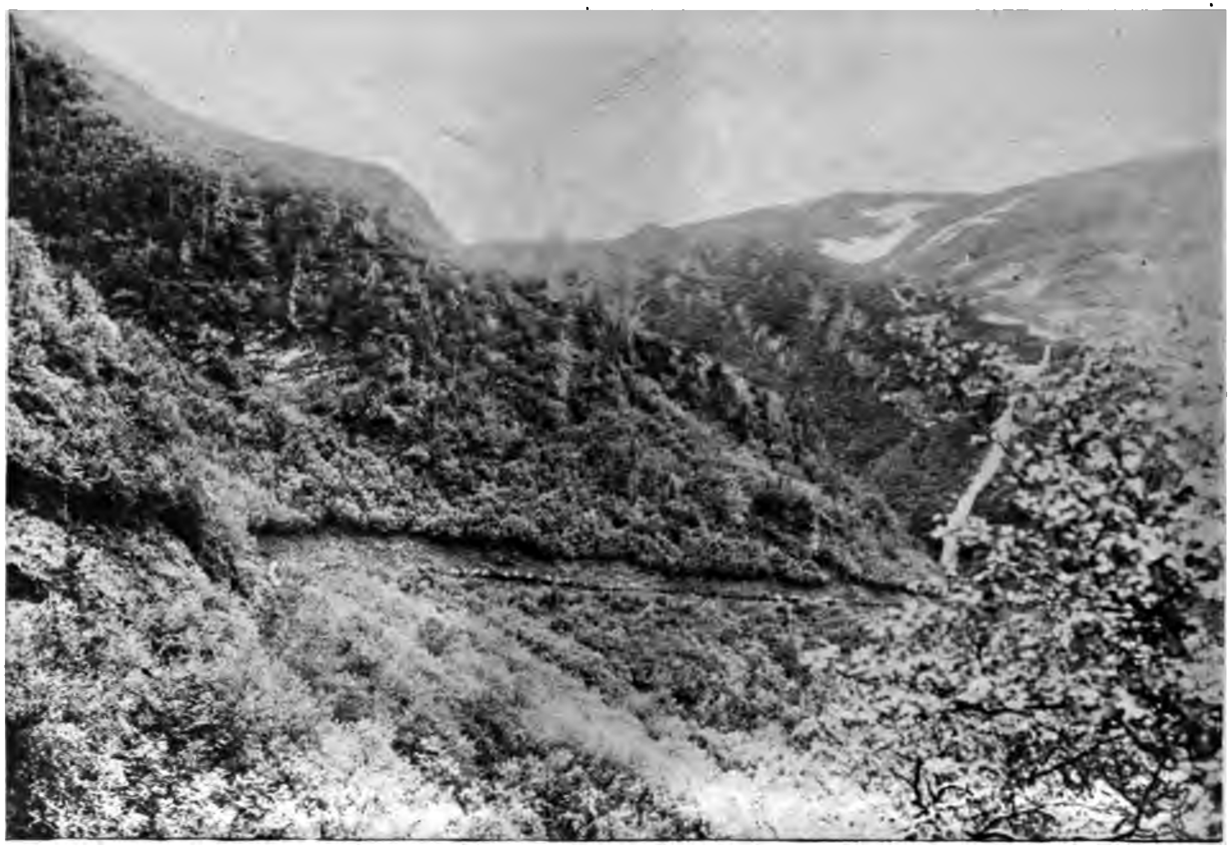
79.—FIRST PACK TRAIN ABOUT TO START FOR STATION NO. 2. "HOTEL" ON LEFT. APRIL 29, 1899.



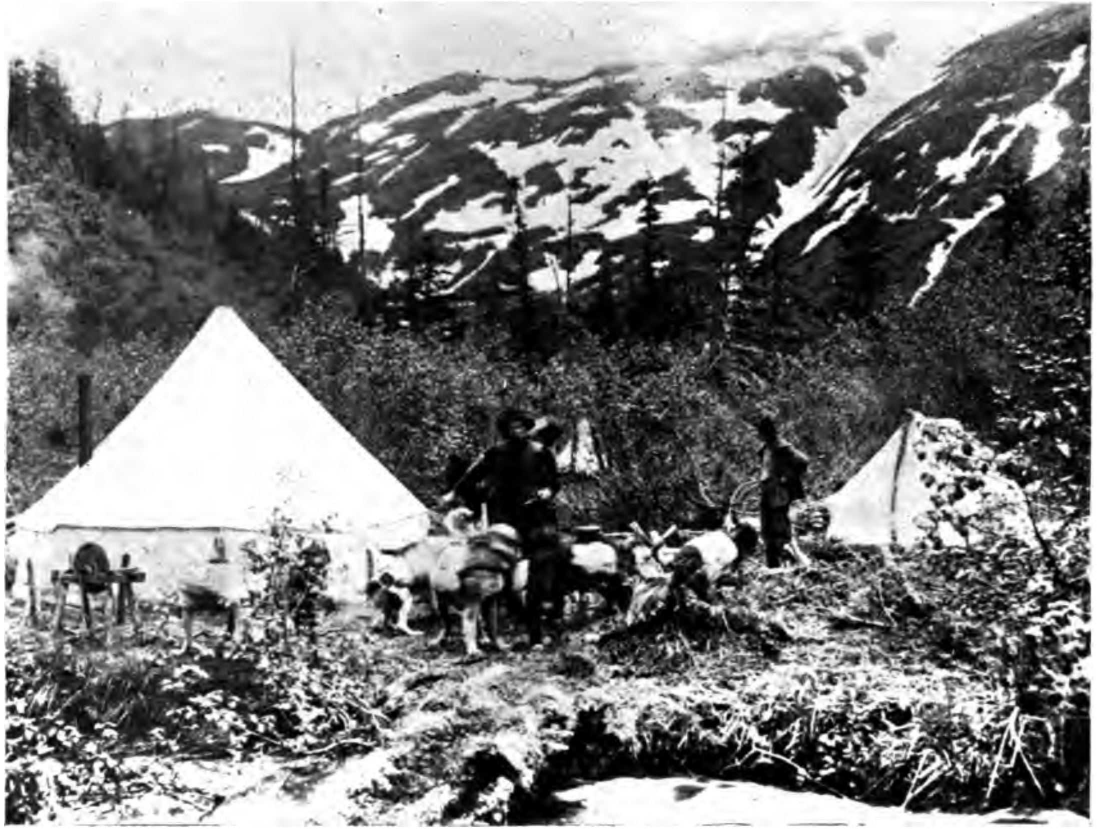
80.—VIEW OF PART OF VALDEZ. MAY 15, 1899.



81.—PACK TRAIN ON MILITARY ROAD IN KEYSTONE CANYON, STARTING FOR THE YUKON RIVER FROM CONSTRUCTION CAMP NO. 2.
JUNE 19, 1899.



82.—PACK TRAIN GOING IN OVER ROAD JUST AFTER ITS COMPLETION THROUGH KEYSTONE CANYON. JUNE 19, 1899.



83.—DOG MASTER FOHLIN AND HIS CHARGES AT CONSTRUCTION CAMP NO. 2. JUNE 19, 1899.

84. IN KEYSTONE CANYON. GOVERNMENT DOG TRAIN GOING OVER ROAD TO INTERIOR. JUNE [illegible]9, 1899.

This gives an idea of the denseness of the vegetation.

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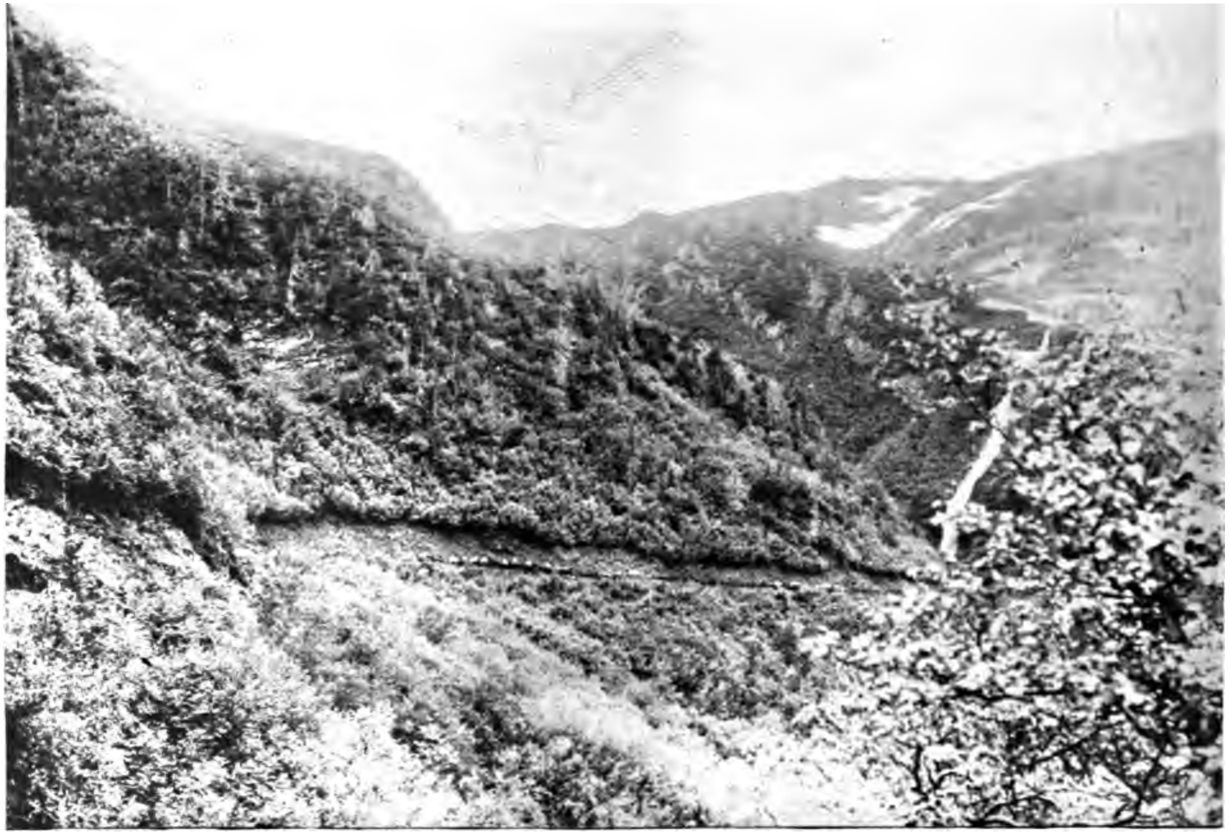

32. PACK TRAIN GOING IN OVER ROAD JUST AFTER ITS COMPLETION THROUGH KEYSTONE CANYON. JUNE 19, 1899.

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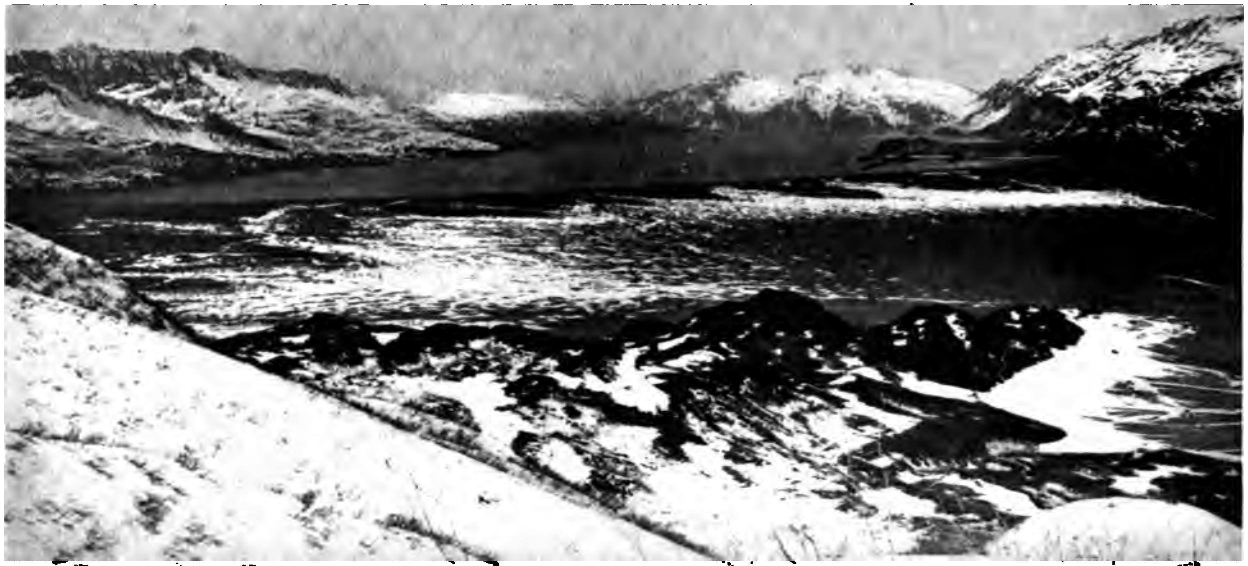
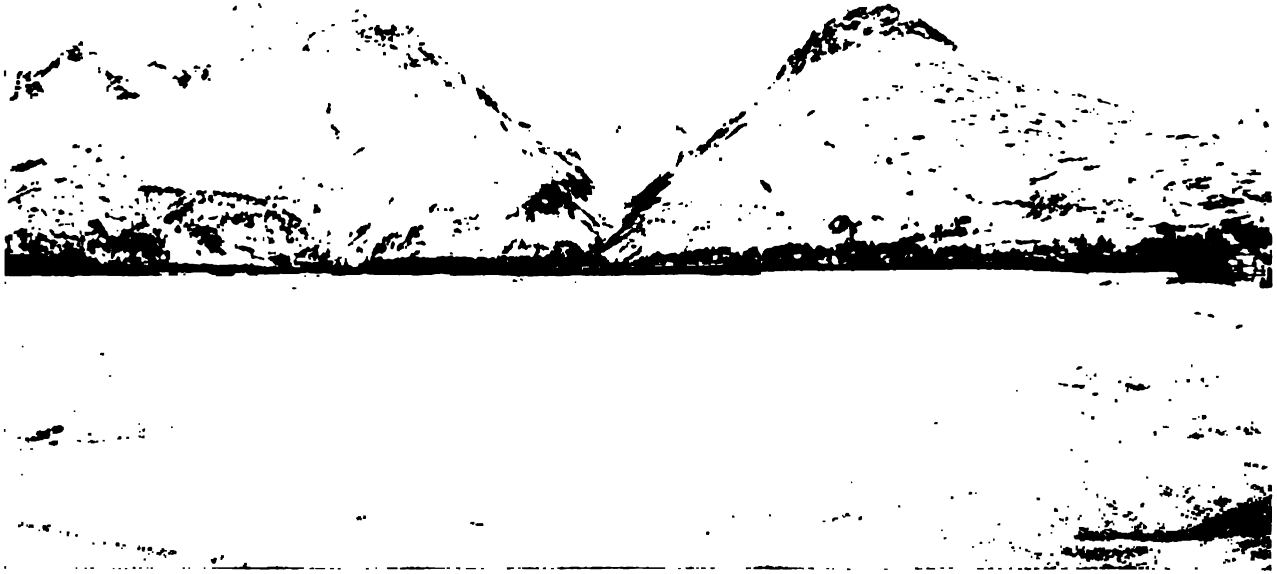
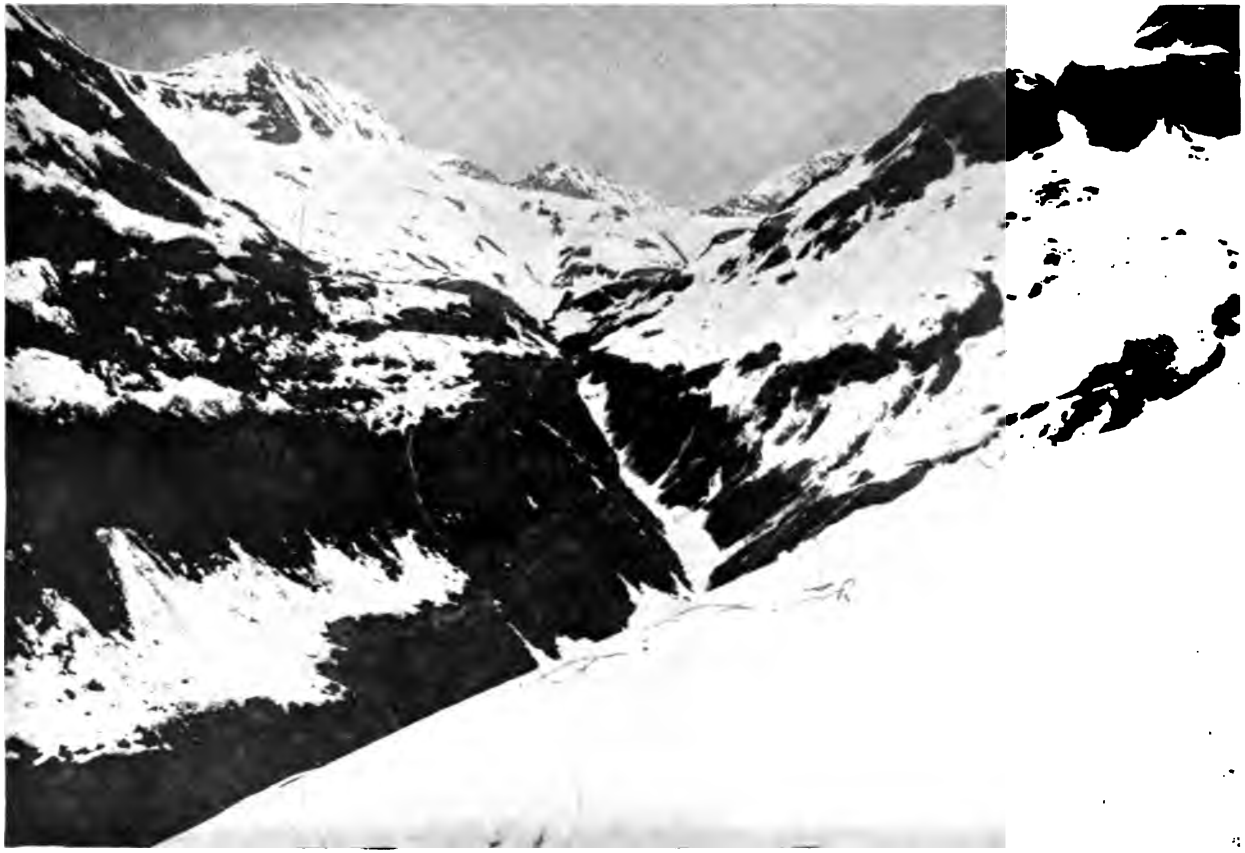


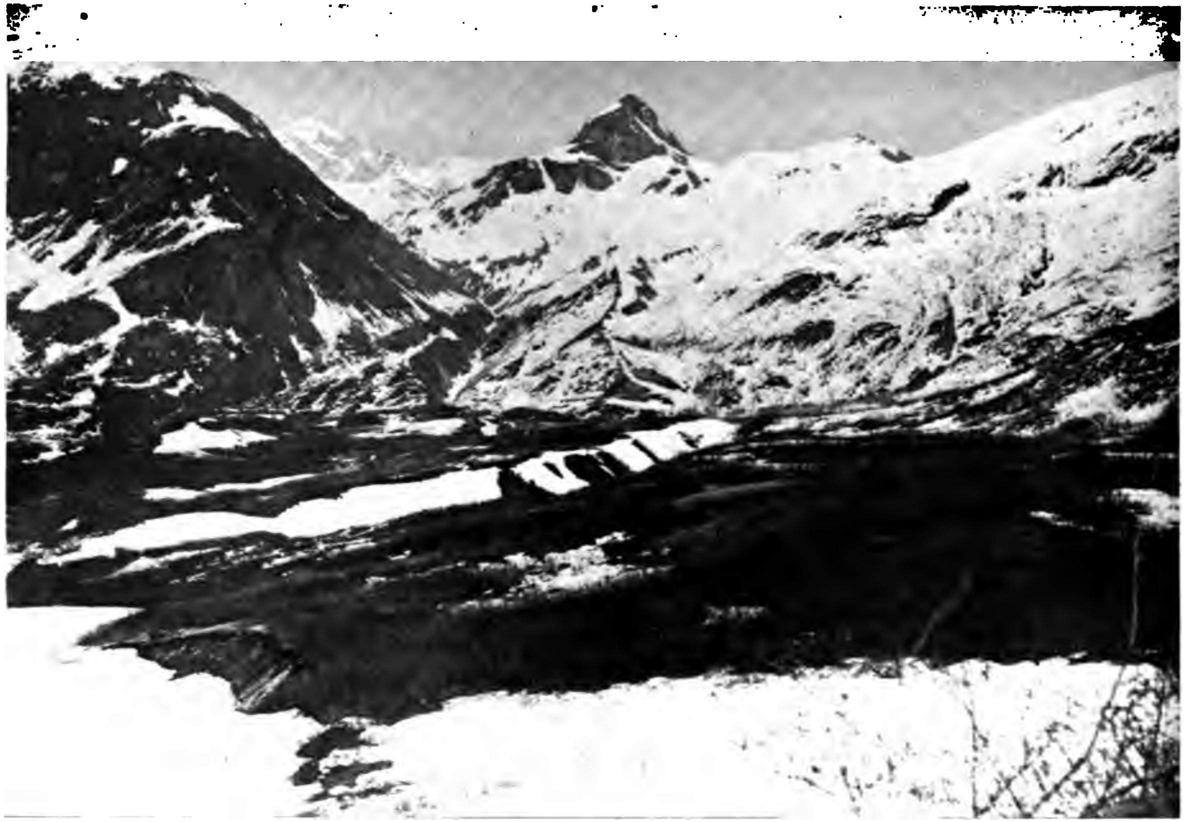
85. VALDEZ BAY, FROM MOUNTAINS EAST OF VALDEZ GLACIER; MOUTH OF LOWE RIVER ON LEFT. MAY 21, 1899.



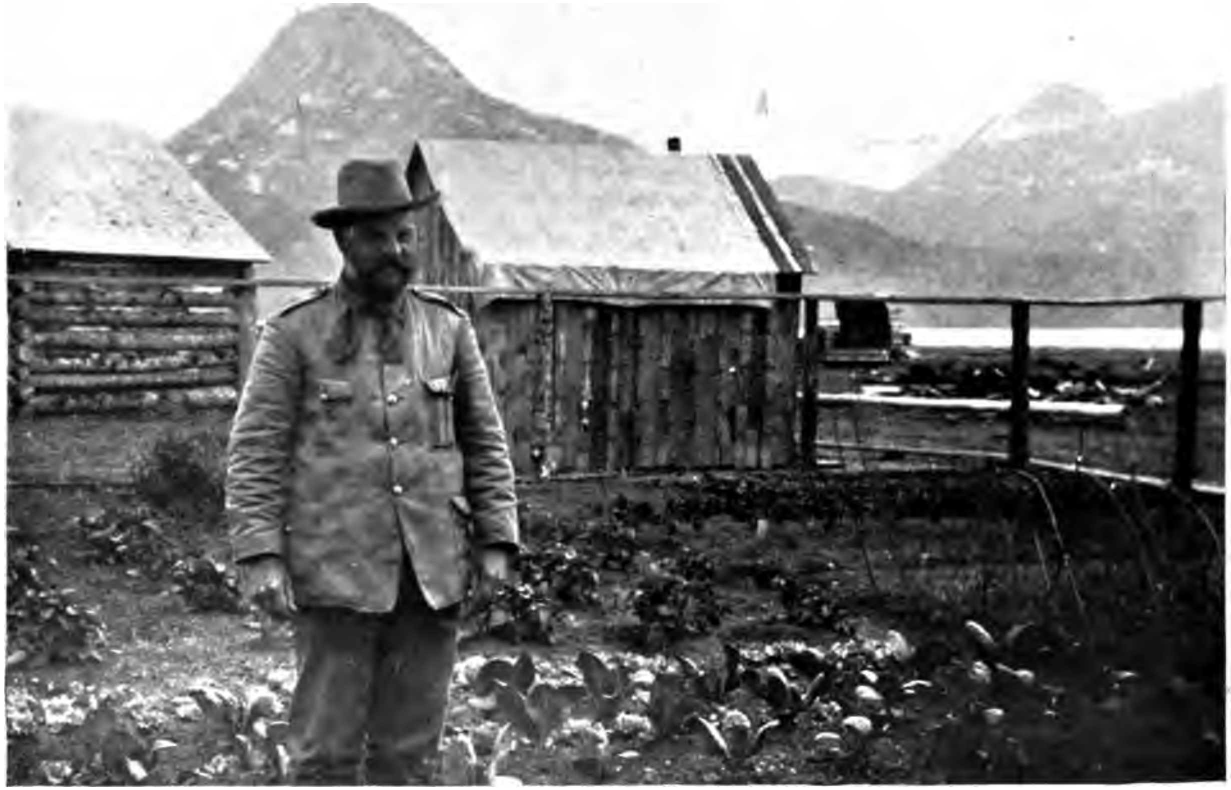
86.—MOUNTAINS SOUTHEAST OF VALDEZ. THE MOUTH OF LOWE RIVER IS ON THE LEFT. MAY 2, 1899.



87.- MOUNTAINS EAST OF VALDEZ GLACIER, FROM AN ELEVATION OF 2,500 FEET. MAY 21, 1899.



88.—MOUNTAINS JUST EAST OF VALDEZ GLACIER. MAY 20, 1899.



89.—CAPTAIN ABERCROMBIE IN EXPERIMENTAL VEGETABLE GARDEN AT VALDEZ. SEPTEMBER 15, 1899.

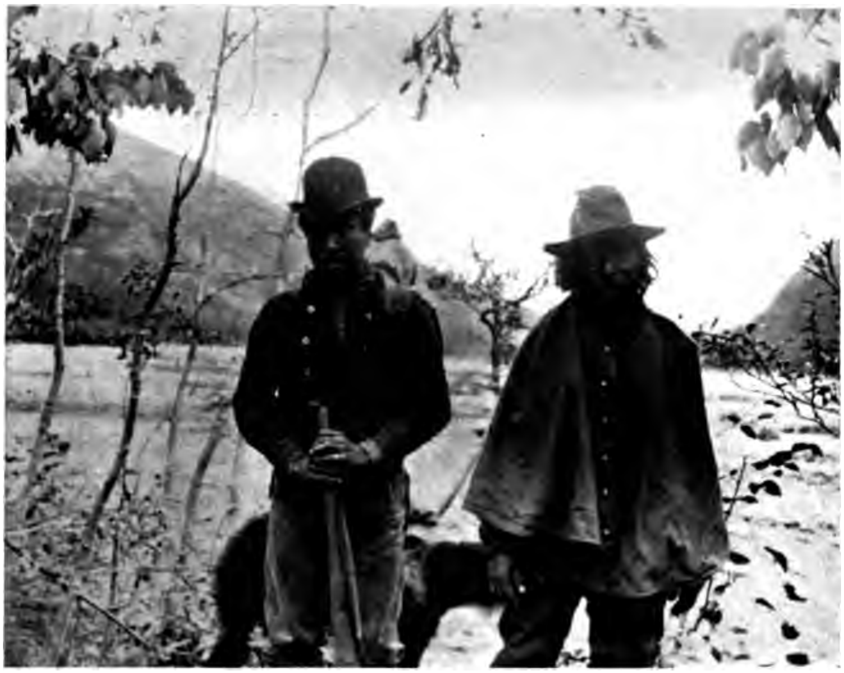
Beets, turnips, raddishes, lettuce, potatoes, oats, cabbages were successfully raised.

90.—CROSSING LOWE RIVER ON FIRST TRIP TO STATION NO. 2. APRIL 29, 1899.

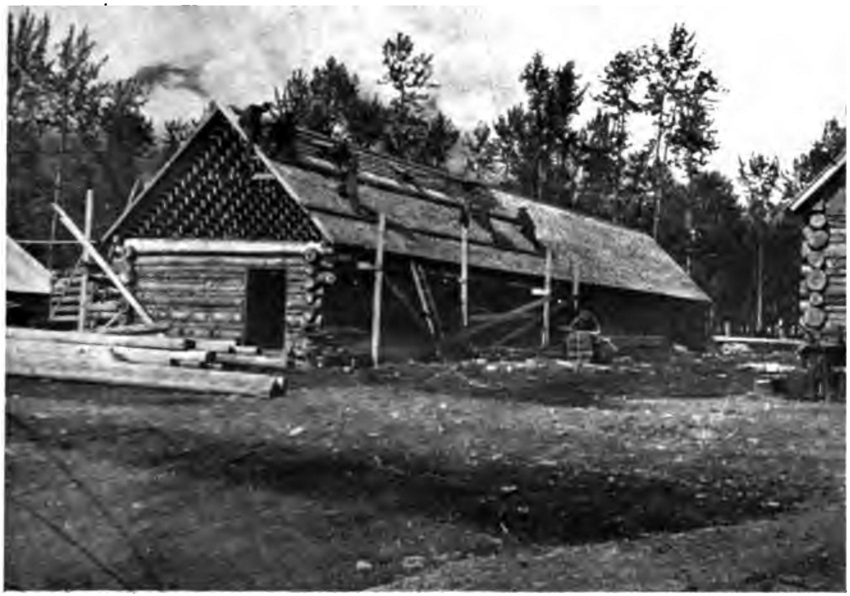
91.—FIRST PACK TRAIN EN ROUTE TO STATION NO. 2. APRIL 29, 1899.

92.—DAVE RHODES, CHIEF PACKER.

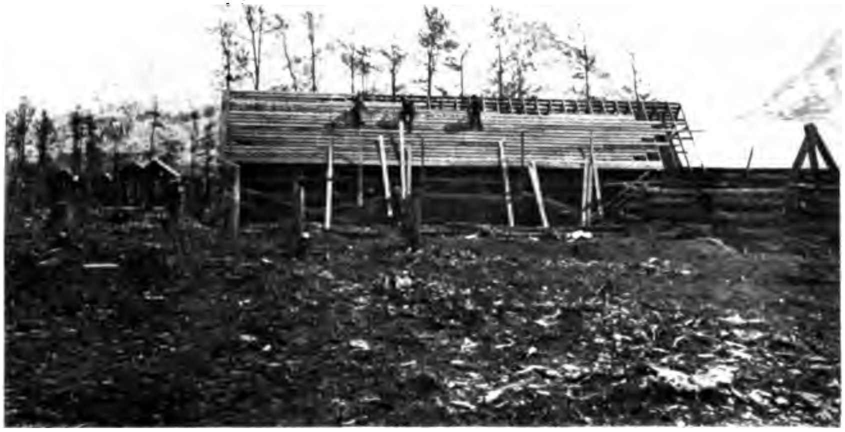
93.—WILLIAM SCHRANTZ, COOK OF CONSTRUCTION CAMP.



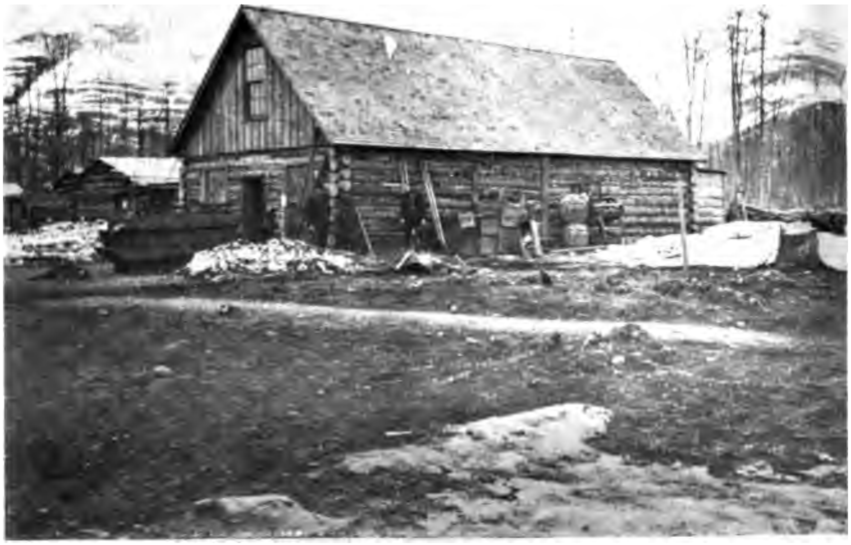
94.—CHIEF STICKWAN AND COMRADE STICKWAN ON RIGHT. SEPTEMBER 15, 1899.



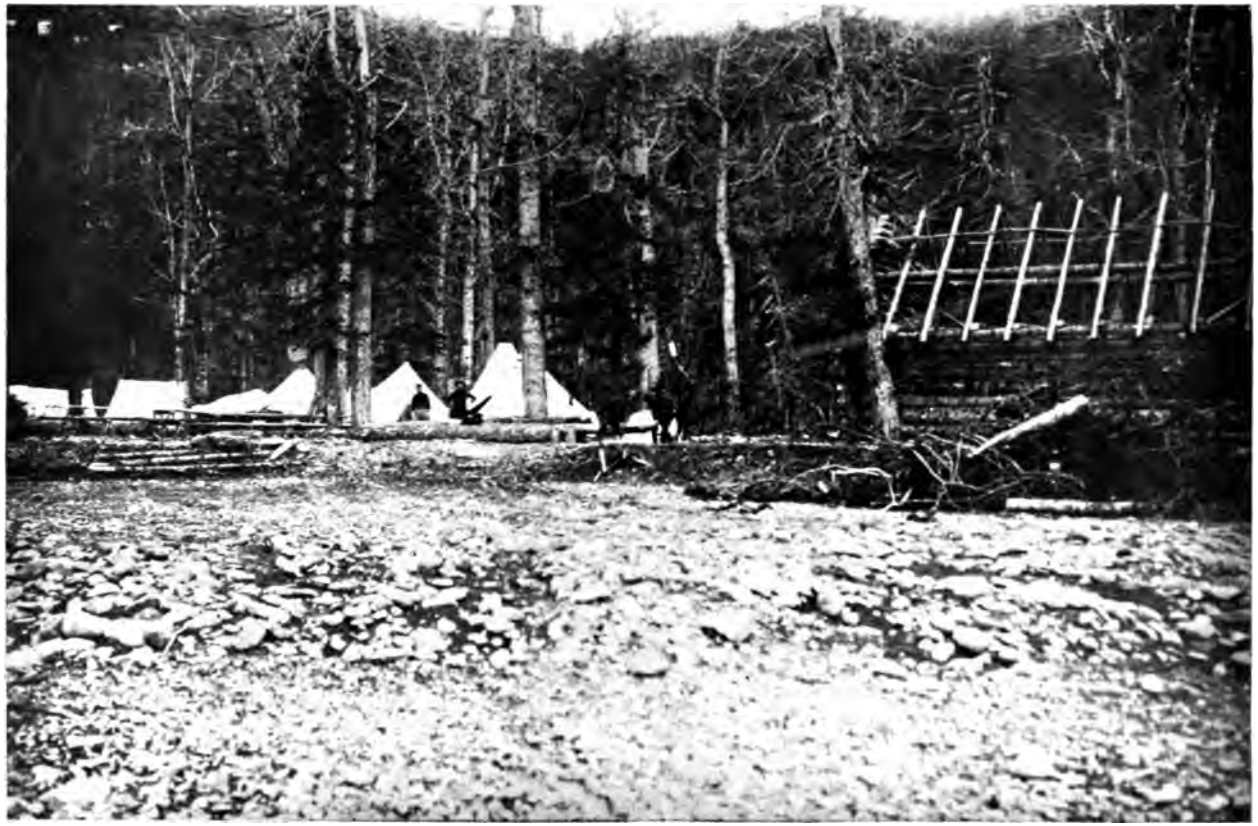
95.—ROOFING GOVERNMENT STABLE AT VALDEZ. SEPTEMBER, 1899.



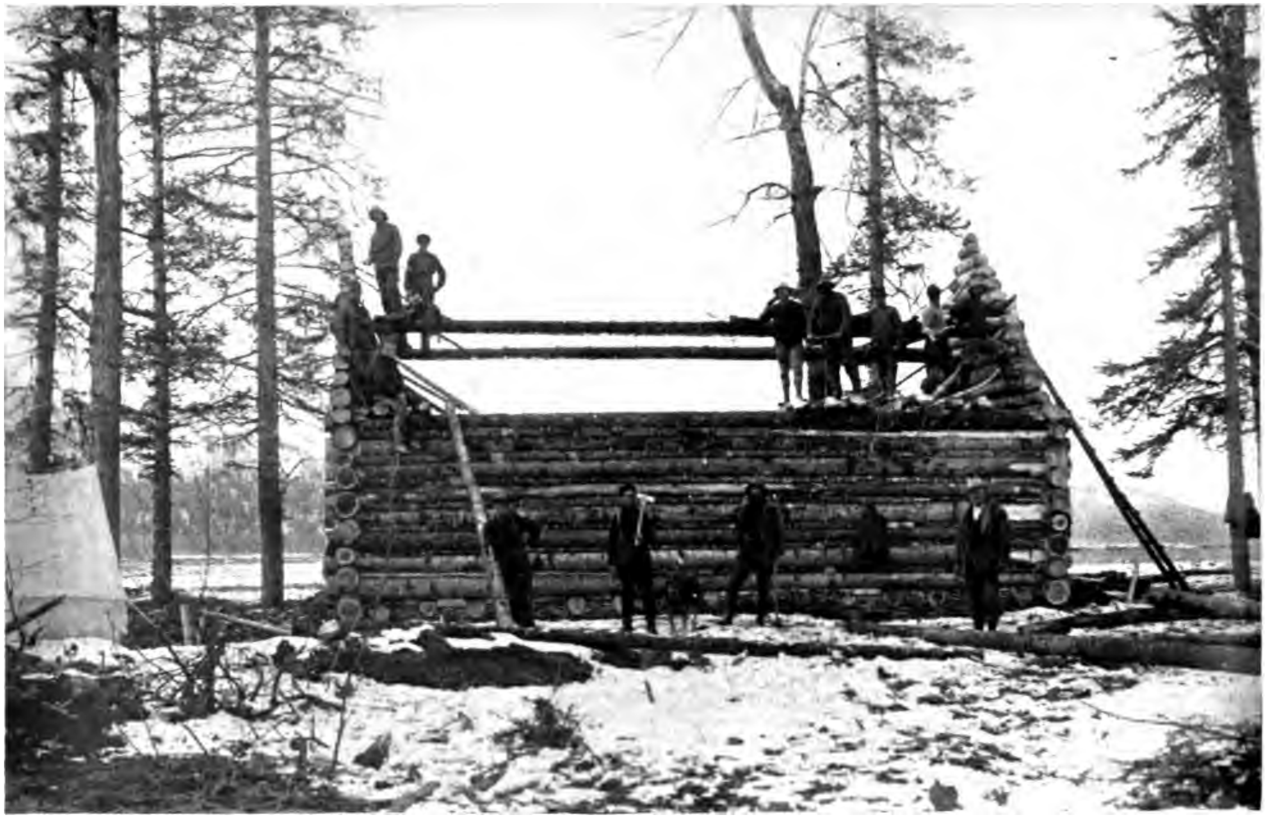
96.—ROOFING GOVERNMENT STABLES AT VALDEZ. MAY 20, 1899.



97.—QUARTERMASTER'S STOREHOUSE AT VALDEZ. MAY 9, 1899.



98.—STATION NO. 2, SHOWING PART OF STOREHOUSE. MAY 15, 1899.

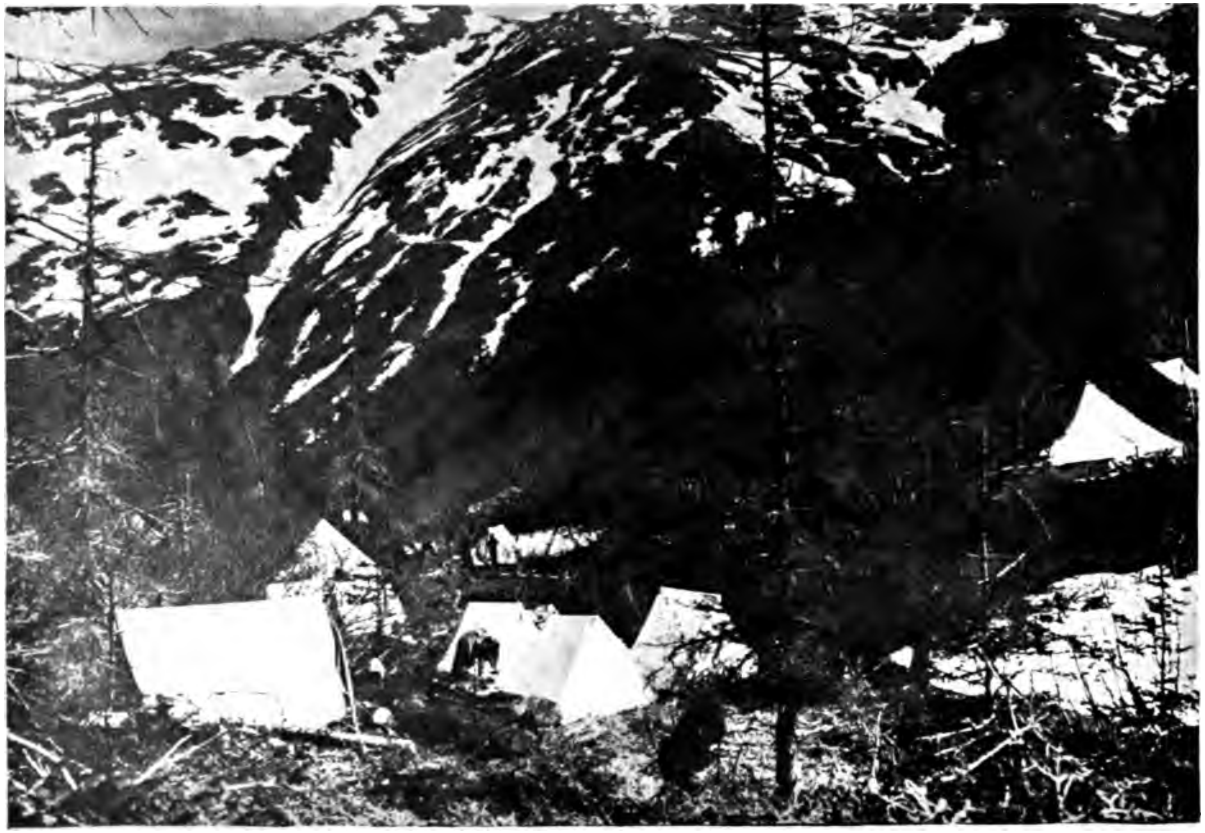


99. -STOREHOUSE AT STATION NO. 2, UNDER CONSTRUCTION. MAY 8, 1899.

100.—CAPT. W. R. ABERCROMBIE, 2D U. S. INFANTRY, COMMANDING EXPEDITION.

101.—DR. NEIL C. TREW, A. A. SURGEON, U. S. A., SURGEON OF THE EXPEDITION.

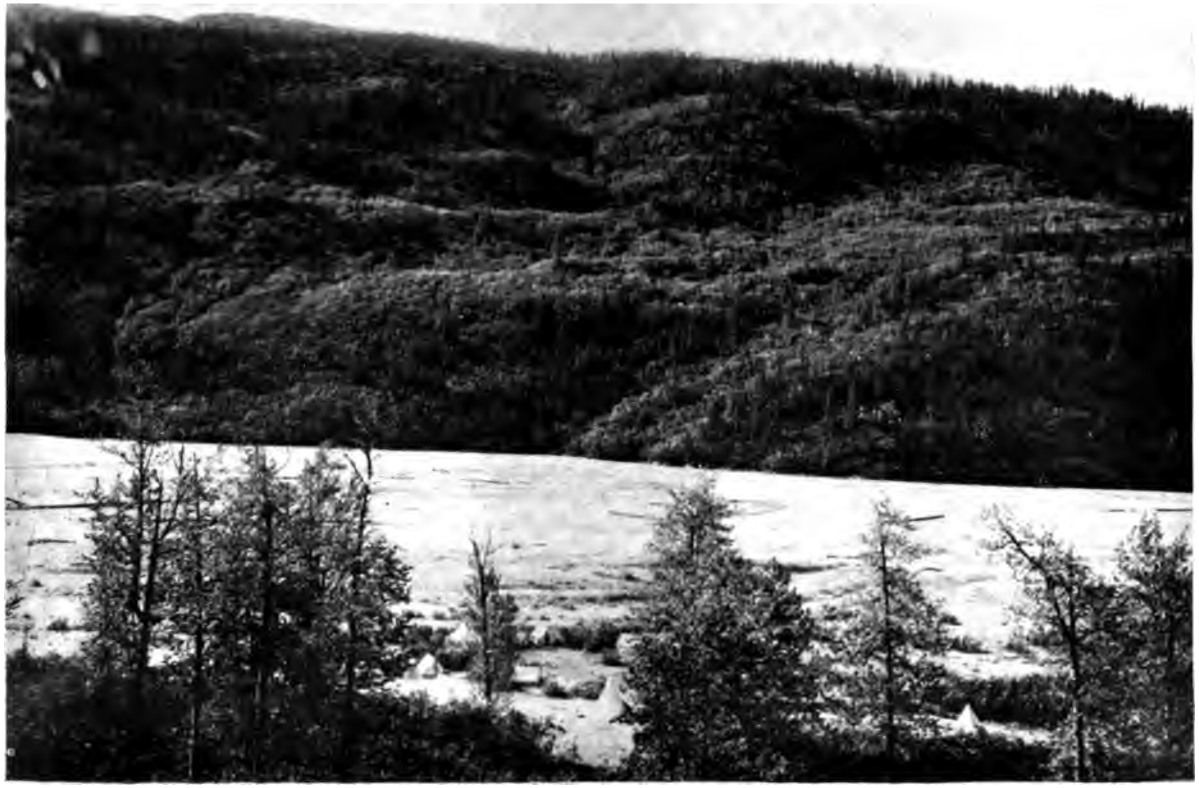
102.—MR. E. M. WESTERVELT, CLERK OF THE EXPEDITION. MAY 12, 1899.



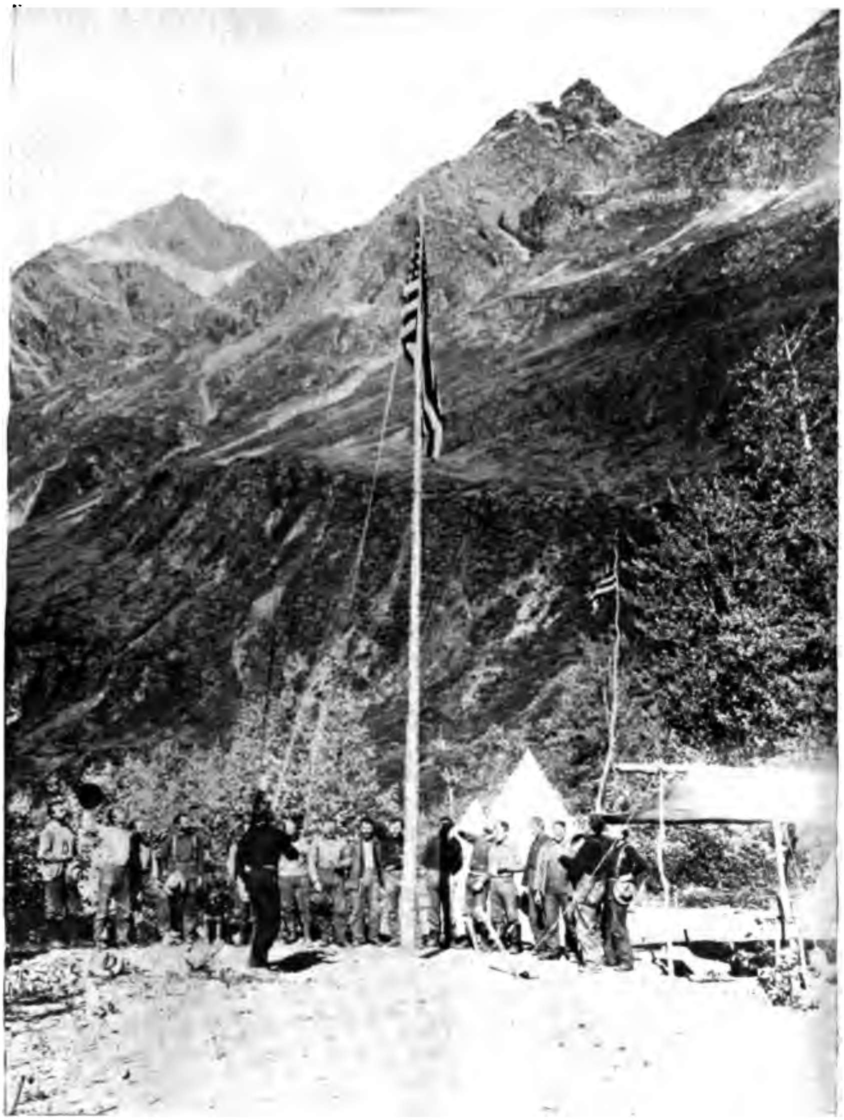
103.—CONSTRUCTION CAMP NO. 2, NEAR KEYSTONE CANYON. JUNE 9, 1899.

104.—MR. EDWARD GILLETTE, RAILROAD ENGINEER.

105.—MR. LARS HOLLAND, FOREMAN OF CONSTRUCTION GANG.

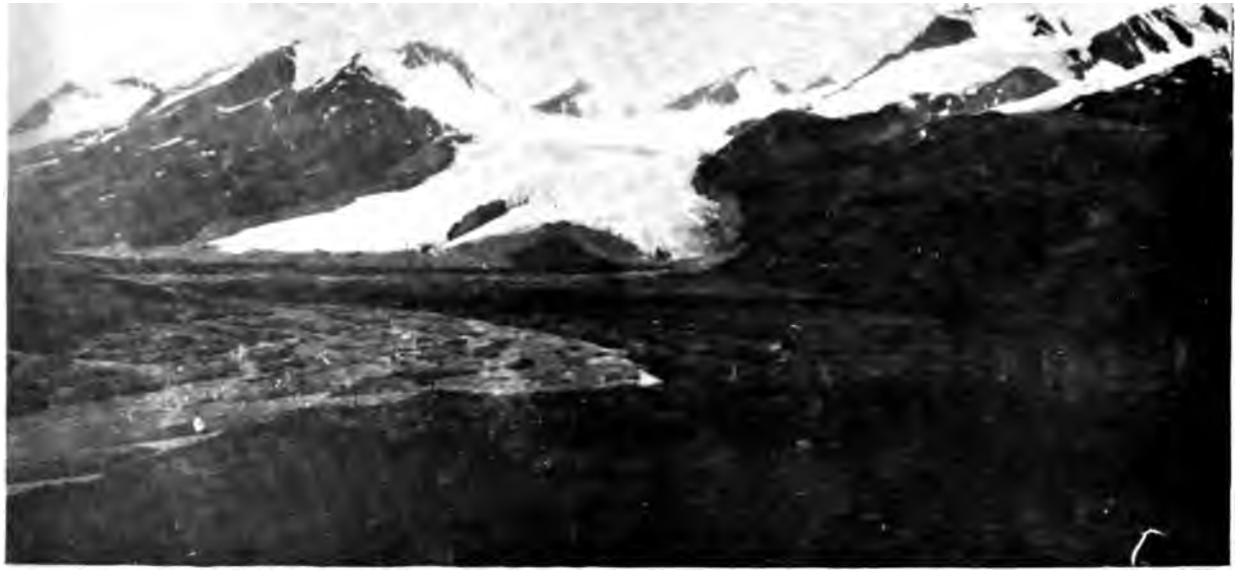


106.—LOOKING SOUTH ACROSS DUTCH FLAT FROM THE ROAD. CONSTRUCTION CAMP NO. 3 IN FOREGROUND. JULY 4, 1899.



107. RAISING FIRST UNITED STATES FLAG ON TRANS-ALASKAN MILITARY ROAD AT CONSTRUCTION CAMP NO. 3. JULY 4, 1899.

This view shows the bench formation of the mountain sides along Dutch Flat. The mountains rise abruptly from the flat and are about 5,500 feet high.



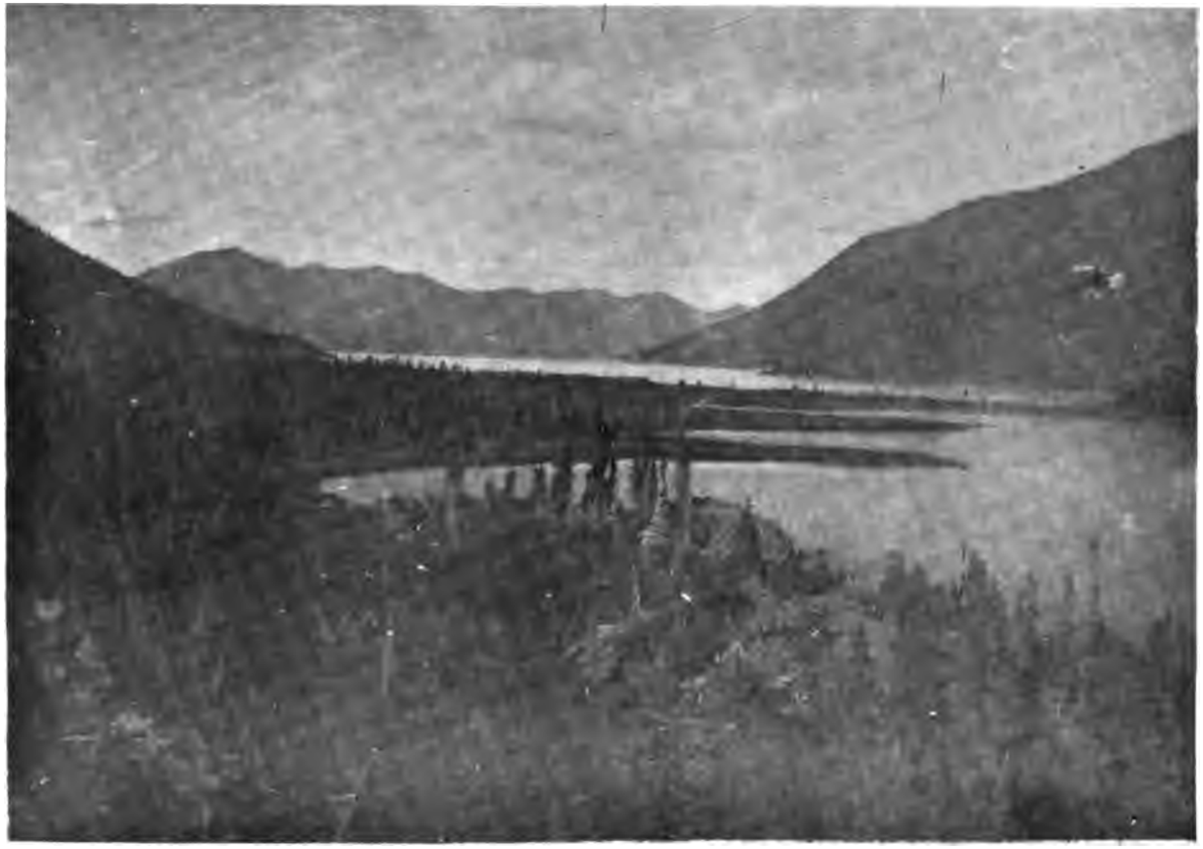
108.—WORTHINGTON GLACIER AND PTARMIGAN CREEK VALLEY, 5 MILES BELOW SUMMIT OF THOMPSON PASS. JULY 28, 1899.

109. LOOKING DOWN THE SECOND GRAVEL FLAT OF THE CHENA. AUGUST, 1899.

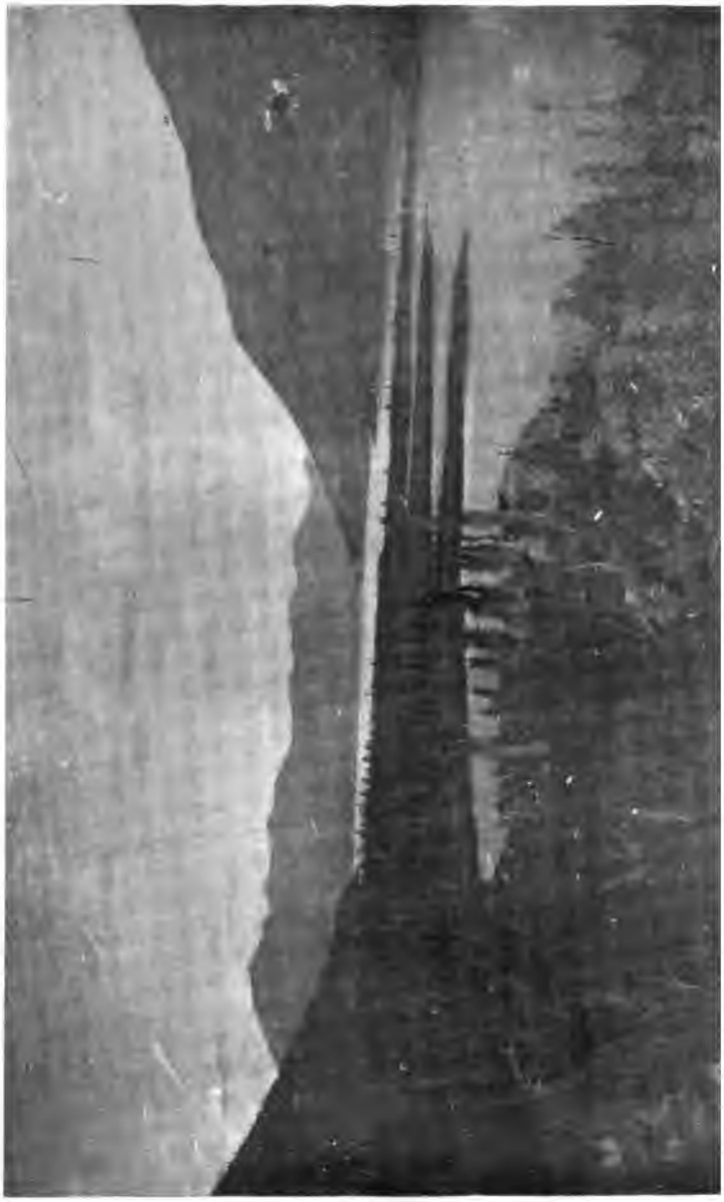
The ridge on the left is the divide between the Chena and the Kanata.

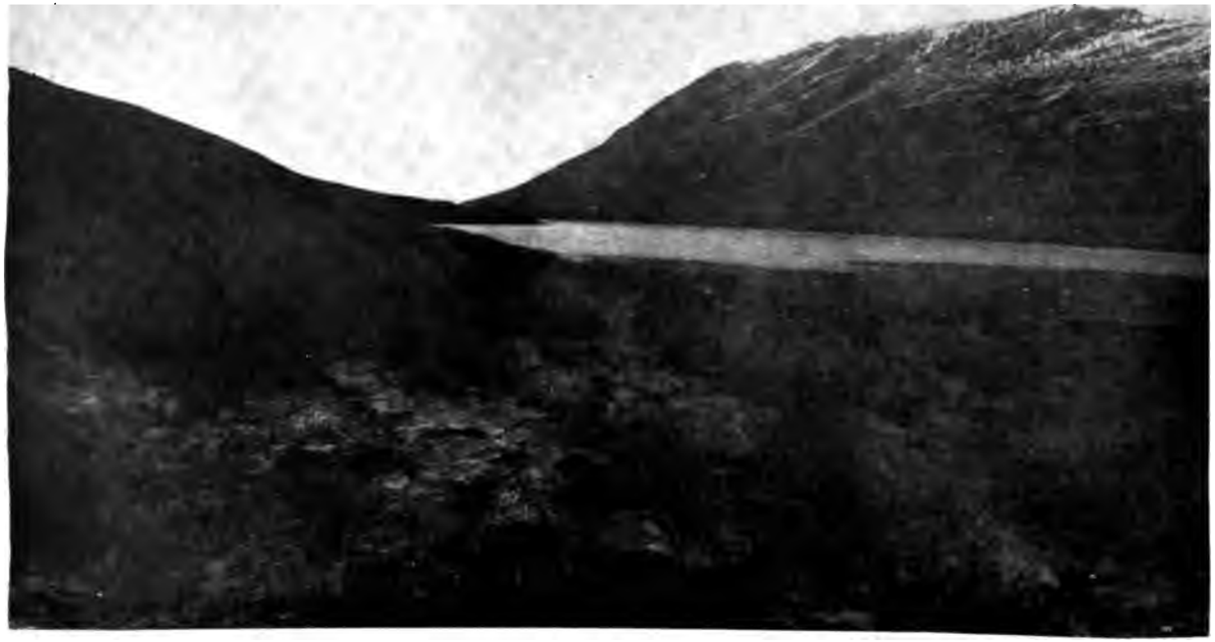
110. –LOOKING UP THE CHENA FROM POINT NEAR STATION NO. 3. AUGUST, 1899.

112.—NORTHERN END OF TONSENA LAKE, LOOKING NORTH TOWARD THE OUTLET. AUGUST, 1899.



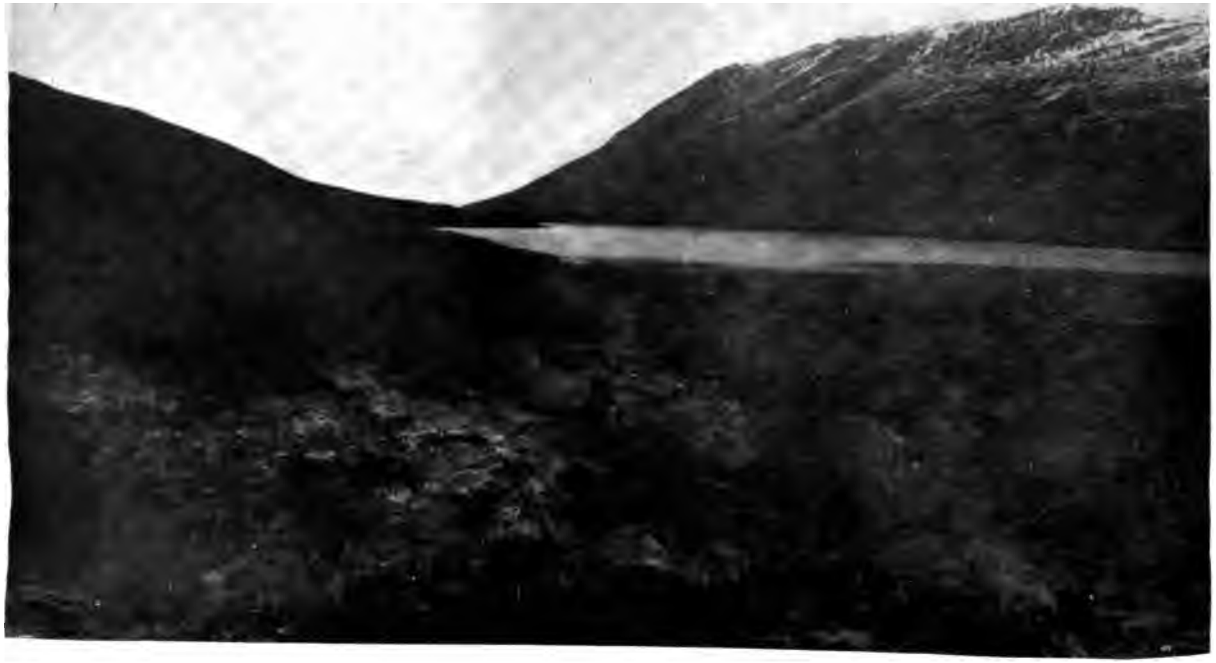
113.—SMALL LAKES ABOVE THE HEAD OF TONSENA LAKE. TONSENA LAKE IN MIDDLE DISTANCE. AUGUST, 1899.



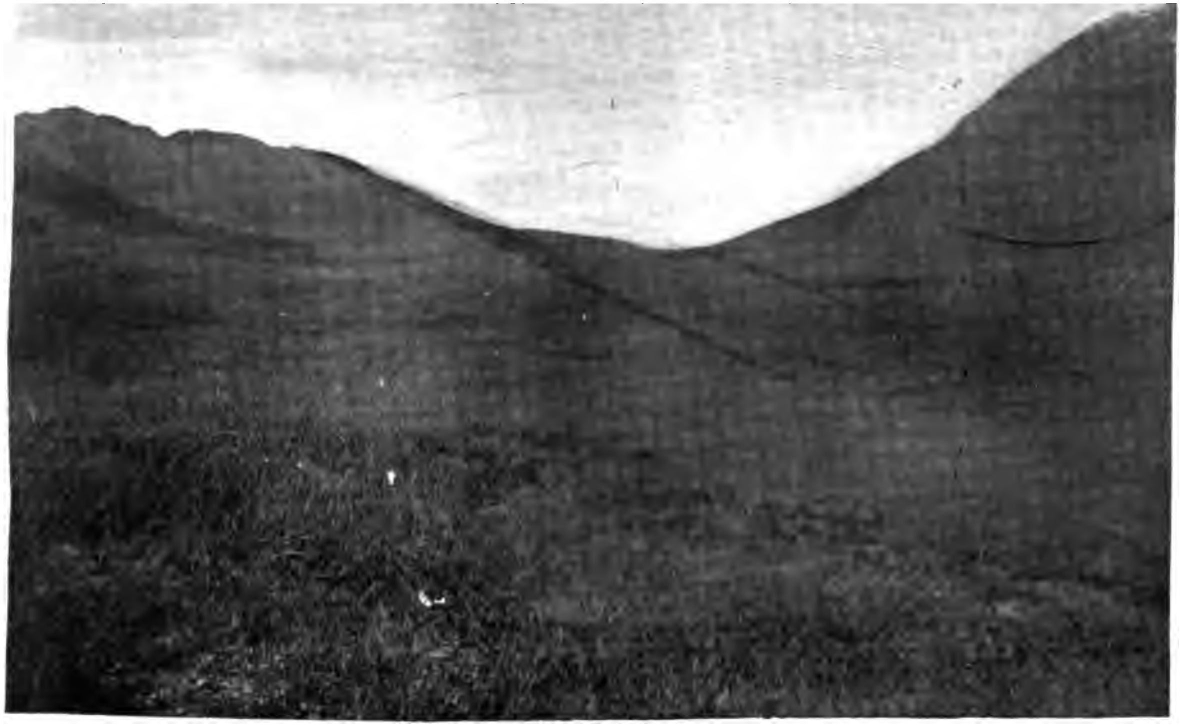


115.—KIMBALL PASS, LOOKING SOUTH. ELEVATION 4,000 FEET. SEPTEMBER 25, 1899.

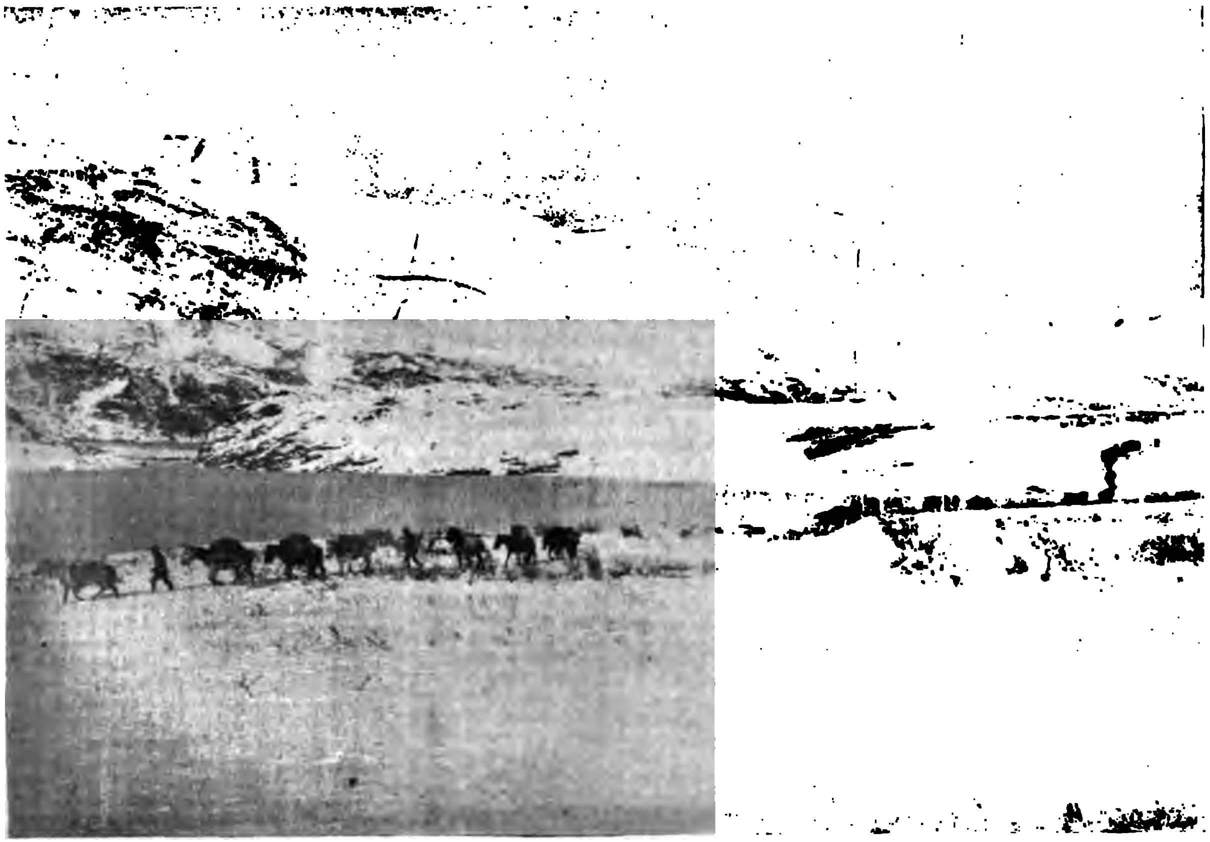
The lake is the source of Bernard Creek and is about one-half mile long.



115.—KIMBALL PASS, LOOKING SOUTH. ELEVATION 4,000 FEET. SEPTEMBER 25 1899

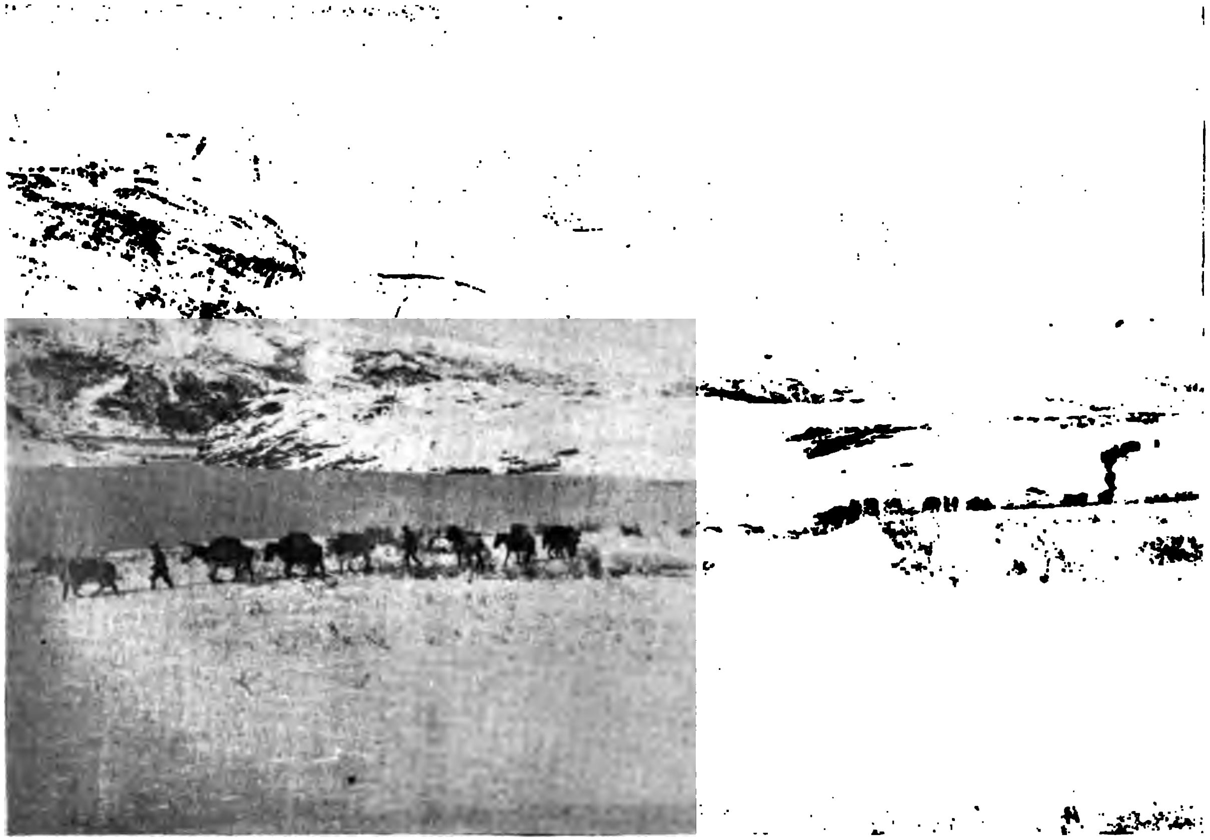


11b. KIMBALL PASS, LOOKING NORTH DOWN BERNARD CREEK. ELEVATION 4,000 FEET. SEPTEMBER 25, 1899.



118.—RETURN OF CONSTRUCTION GANG TO VALDEZ. PACK TRAIN ON ASCENT TO THOMPSON PASS. OCTOBER 8, 1889.

It was just beyond the lake shown in picture that the horses played out.



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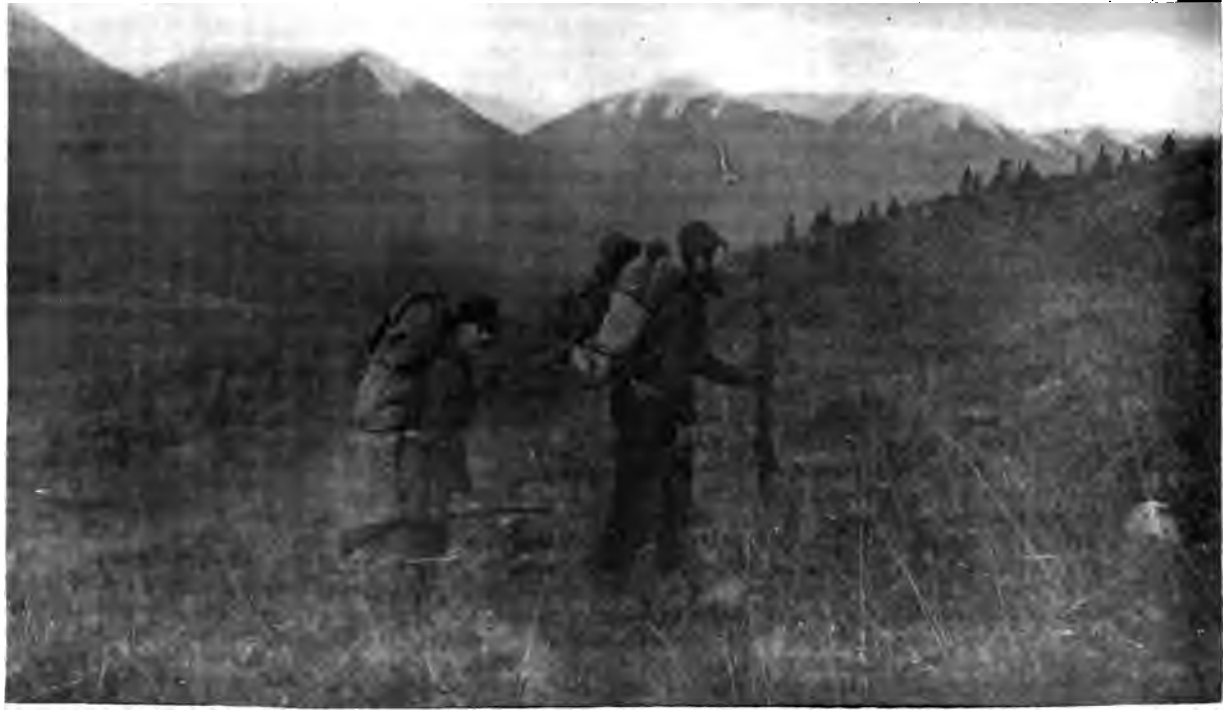
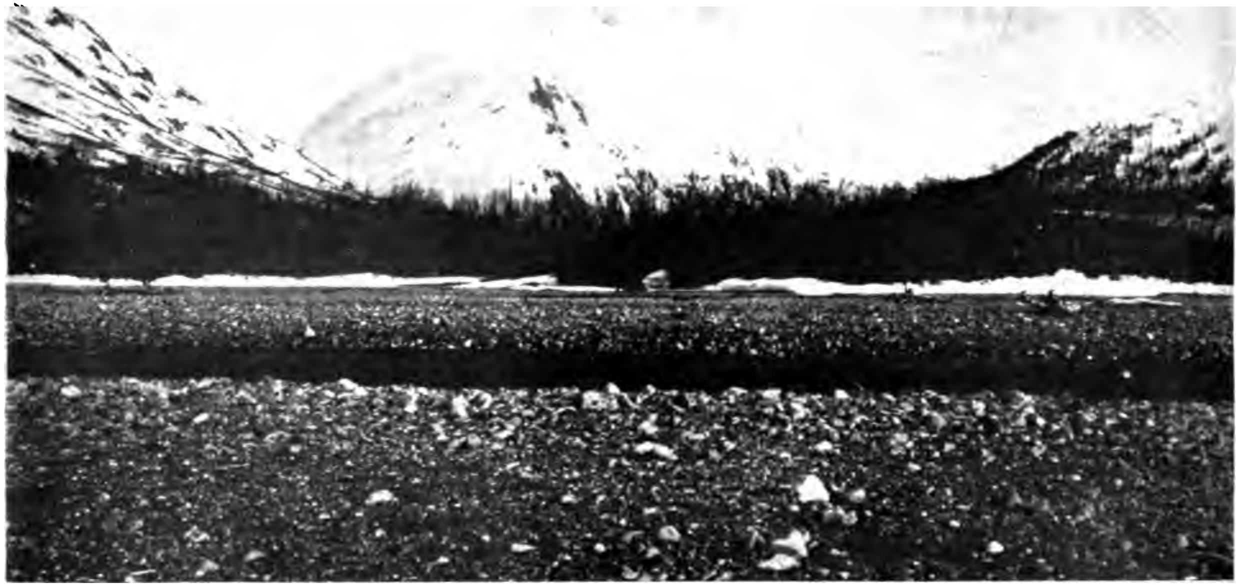
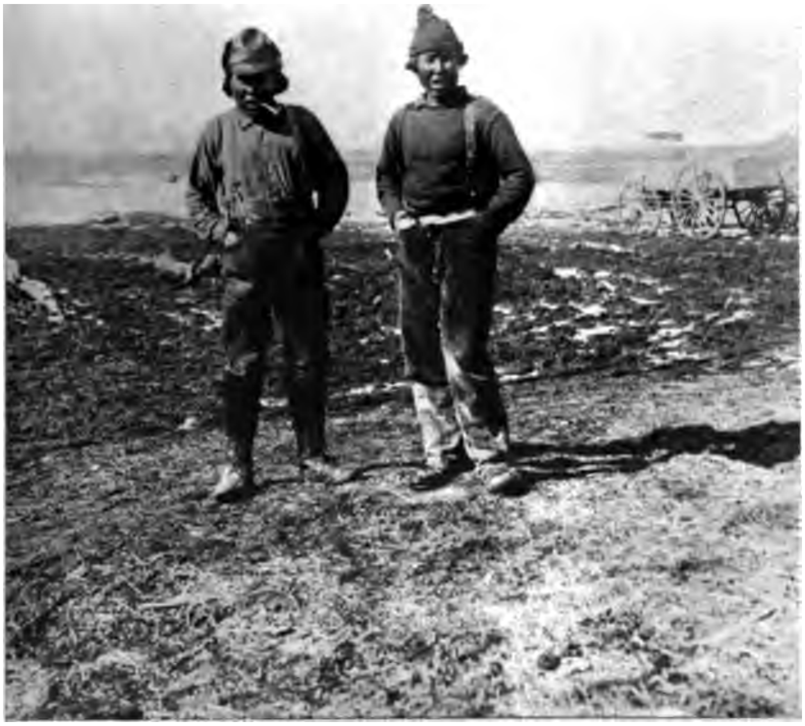


119.—THE POOR PROSPECTORS ONLY MEANS OF GETTING FOOD SUPPLIES INTO THE INTERIOR. SEPTEMBER 25, 1899.



120. MOUNTAIN SOUTHEAST OF STATION NO. 2, AS SEEN FROM STATION NO. 2. ELEVATION ABOUT 5,000 FEET. MAY 15, 1899.

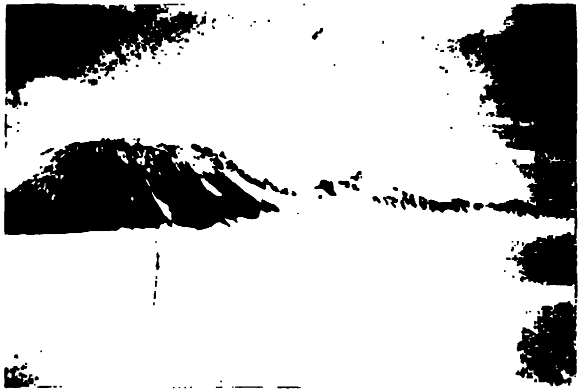


121.—TWO DESTITUTE STICK INDIANS ON THEIR ARRIVAL AT VALDEZ. APRIL 26, 1899.

125.—LOOKING DOWN THE NEZENA RIVER FROM THE FORKS. AUGUST, 1899.

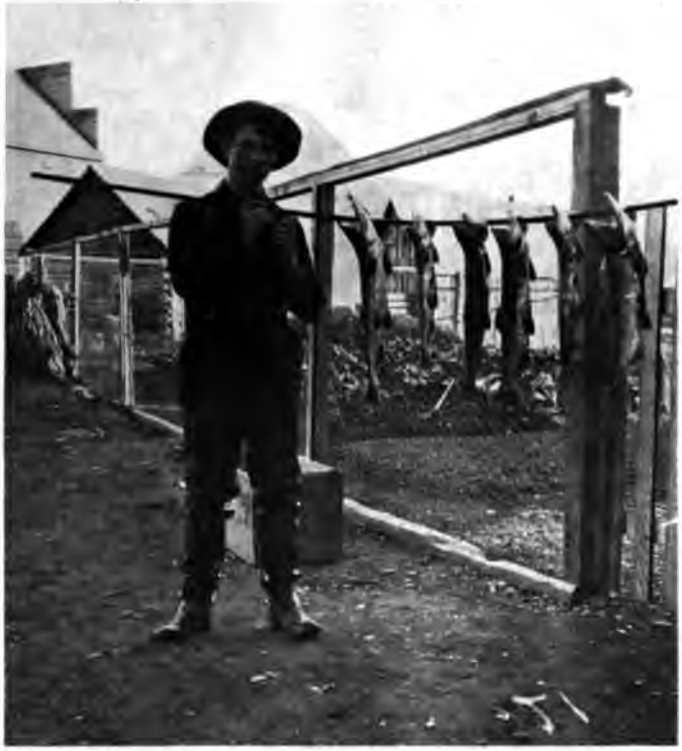
126. —CAMP AT FOOT OF NEZENA GLACIER. AUGUST, **1899.**

127.—SUMMIT OF NEZENA GLACIER, LOOKING NORTH. AUGUST, 1899.

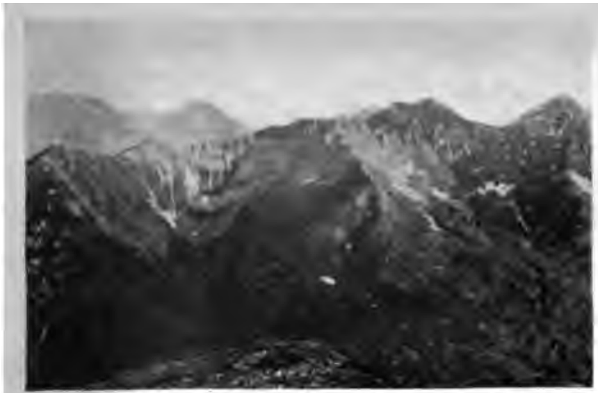


128.—SUMMIT OF NEZENA GLACIER, LOOKING NORTHEAST. AUGUST, 1899.

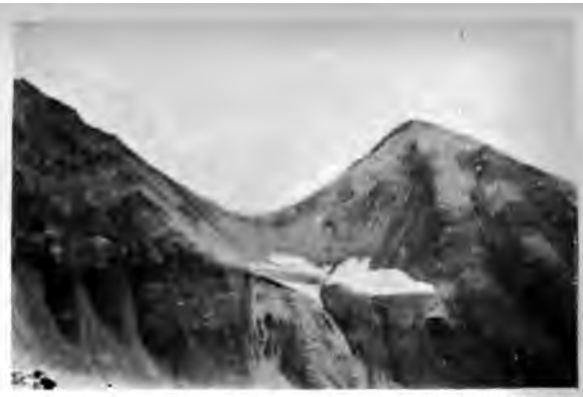
123.—LIEUTENANT BABCOCK—KEYSTONE CANYON. MAY 12, 1899.



124.—A SMALL CATCH OF SALMON. CORNER OF EXPERIMENTAL VEGETABLE GARDEN AT VALDEZ. SEPTEMBER 10, 1899.

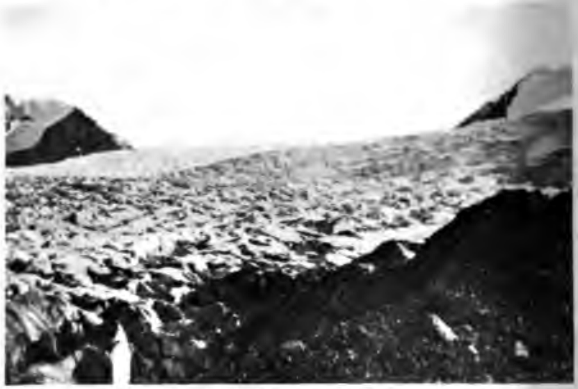


137.—IN THE WRANGELL GROUP; A "MUD GLACIER" ON THE LEFT. AUGUST, 1899.



138.—IN THE WRANGELL GROUP, SHOWING THE PECULIAR AMPHITHEATER FORM OF EROSION DUE TO LOCAL GLACIATION. AUGUST, 1899.

139.—LOOKING NORTHEAST TOWARD THE SUMMIT OF THE NEZENA GLACIER. AUGUST, 1899.



140.—LOOKING UP THE TANANA GLACIER, SHOWING THE JUNCTION OF THE EAST AND WEST LOBES. AUG 1899.

141.—CREVASSES NEAR SUMMIT OF THE NEZENA GLACIER. AUGUST, 1899.

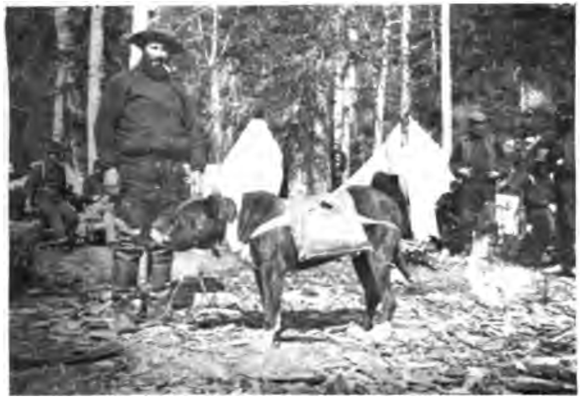
142.—LOOKING UP THE NEZENA GLACIER, 2 MILES FROM THE SUMMIT. AUGUST, 1899.

143.—SLEDDING SUPPLIES OVER THE NEZENA GLACIER. AUGUST, 1899.

144.—VIEW OF THE MENTASTA MOUNTAINS, LOOKING NORTH-WEST. SEPTEMBER, 1899.

145.—LOADING BEEF CATTLE ON STEAMER EXCELSIOR AT SEATTLE. APRIL 15, 1899.

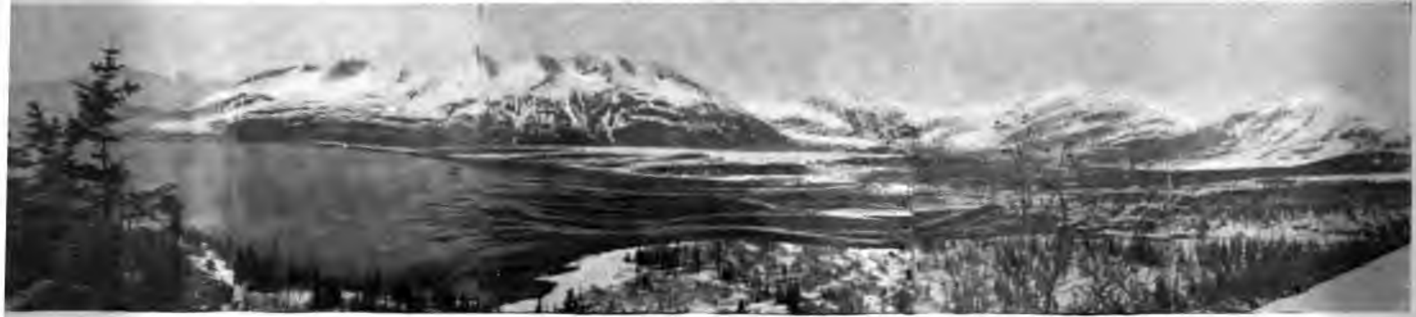
146. MOUNTAIN SHEEP, KILLED NEAR NEZENA RIVER. AUGUST, 1899.



147.—SHOWING METHOD OF USING DOGS FOR TRANSPORTATION PURPOSES IN SUMMER MONTHS.

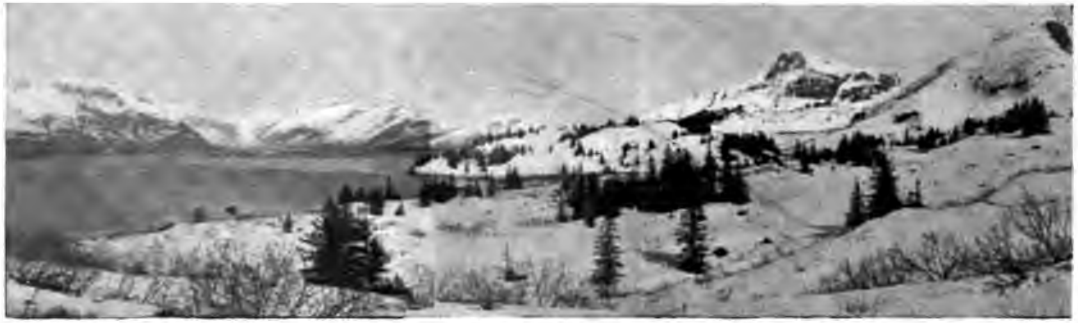
The load is from 35 to 50 pounds to a dog.

148.—PROSPECTOR'S CABIN ON THE CHISTACHINE, 23 MILES ABOVE THE MOUTH. SEPTEMBER, 1899.



49.—PANORAMIC VIEW FROM THE FOOTHILLS JUST ABOVE LUDINGTON'S LANDING, SHOWING THE HEAD OF VALDEZ BAY AND MUD FLATS, AND MOUTH OF LOWE RIVER. MAY 10, 1899.

he foot of Valdez Glacier is at the base of the mountains just to the right of center. Robe Lake is indicated by the white portion at the base of the mountains on the right. The center of this picture is in a direction about north from point of view.

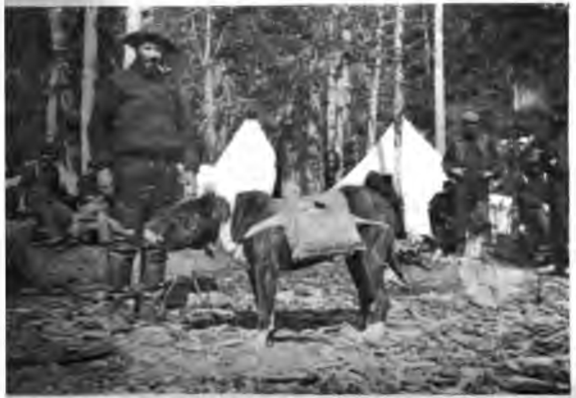


150.—HEAD OF VALDEZ BAY AND FOOTHILLS ABOVE SWANPORT. MAY 11, 1899.

The foreground and middle distance shows the most favorable site for a military post. Valdez Glacier is shown at the head of the bay in the left center.

145.—LOADING BEEF CATTLE ON STEAMER EXCELSIOR AT SEATTLE. APRIL 15, 1899.

146.—MOUNTAIN SHEEP, KILLED NEAR NEZENA RIVER. AUGUST, 1899.



147.—SHOWING METHOD OF USING DOGS FOR TRANSPORTA-

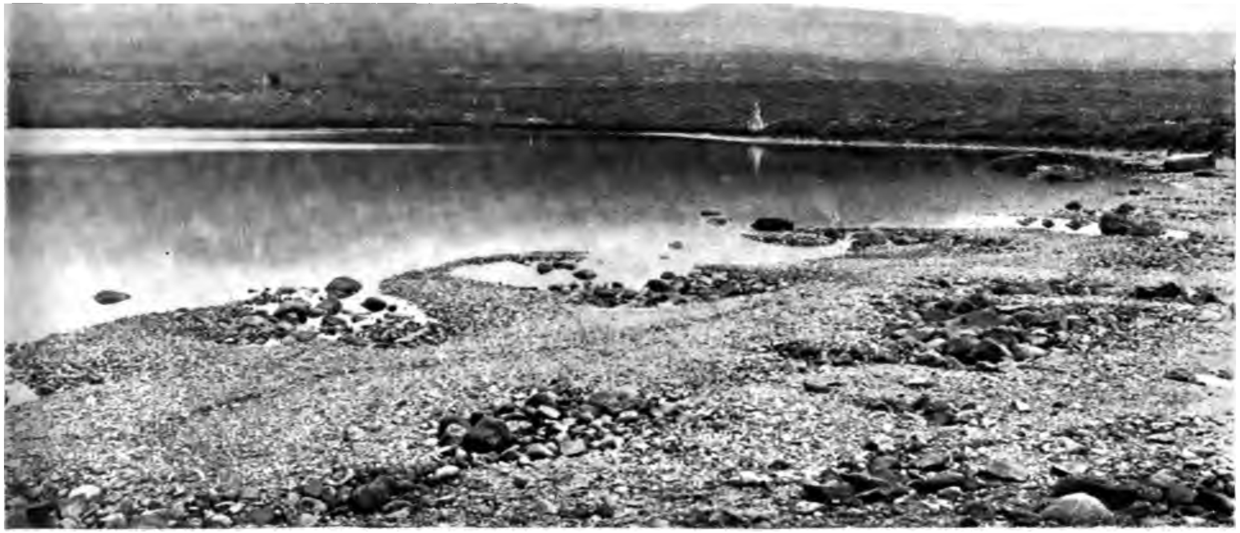
ER MONTHS.

unds to a dog

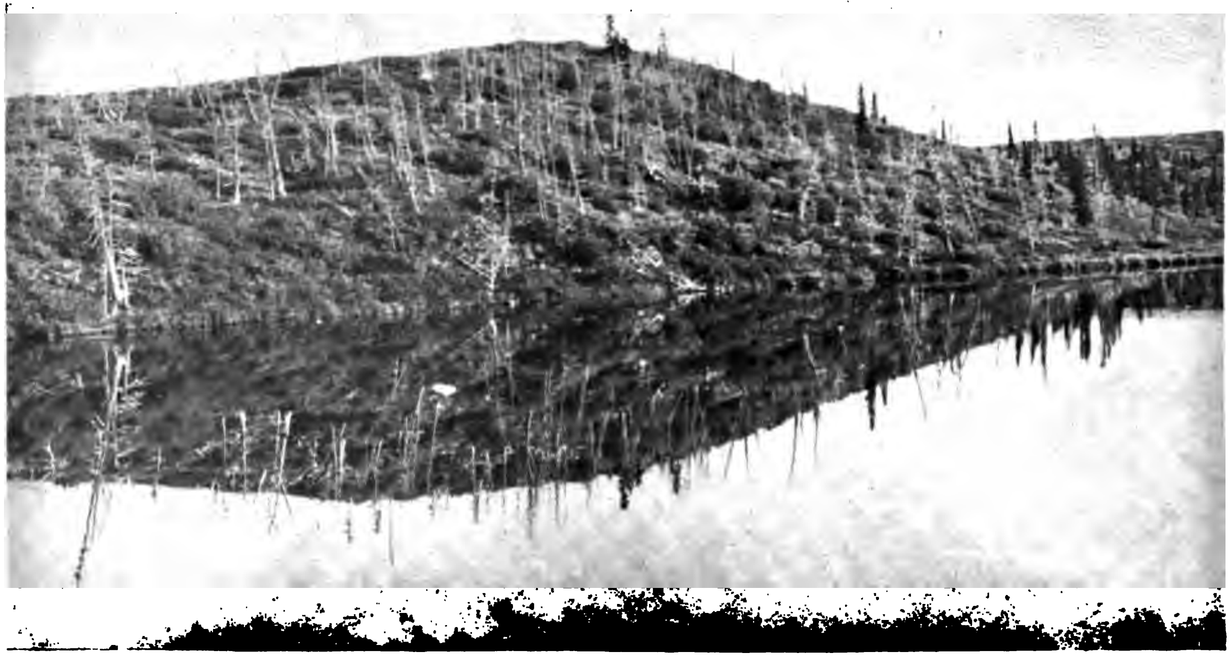
148.—PROSPECTOR'S CABIN ON THE CHISTACHINE, 23 M

ABOVE THE MOUTH. SEPTEMBER, 1899.

152.—MENTASTA PASS, LOOKING EAST.

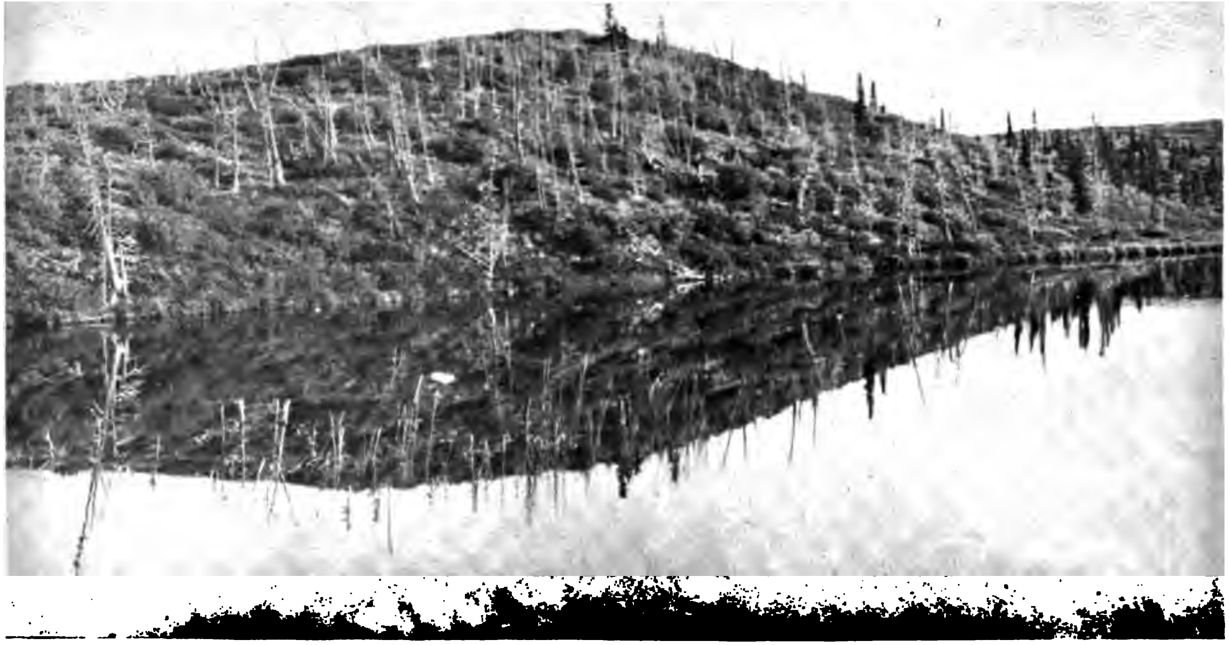


153.—AT THE FOOT OF MOUNT DRUM; SUMMER SNOW SQUALL.



154.—ONE OF THE SMALL LAKES CHARACTERISTIC OF THE COPPER RIVER VALLEY.

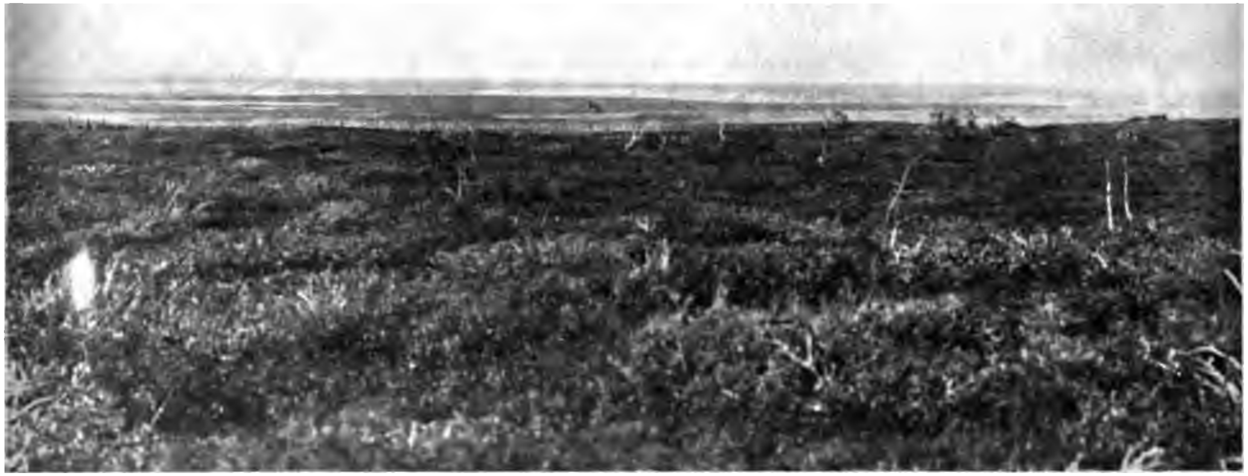
153.—AT THE FOOT OF MOUNT DRUM; SUMMER SNOW SQUALL.



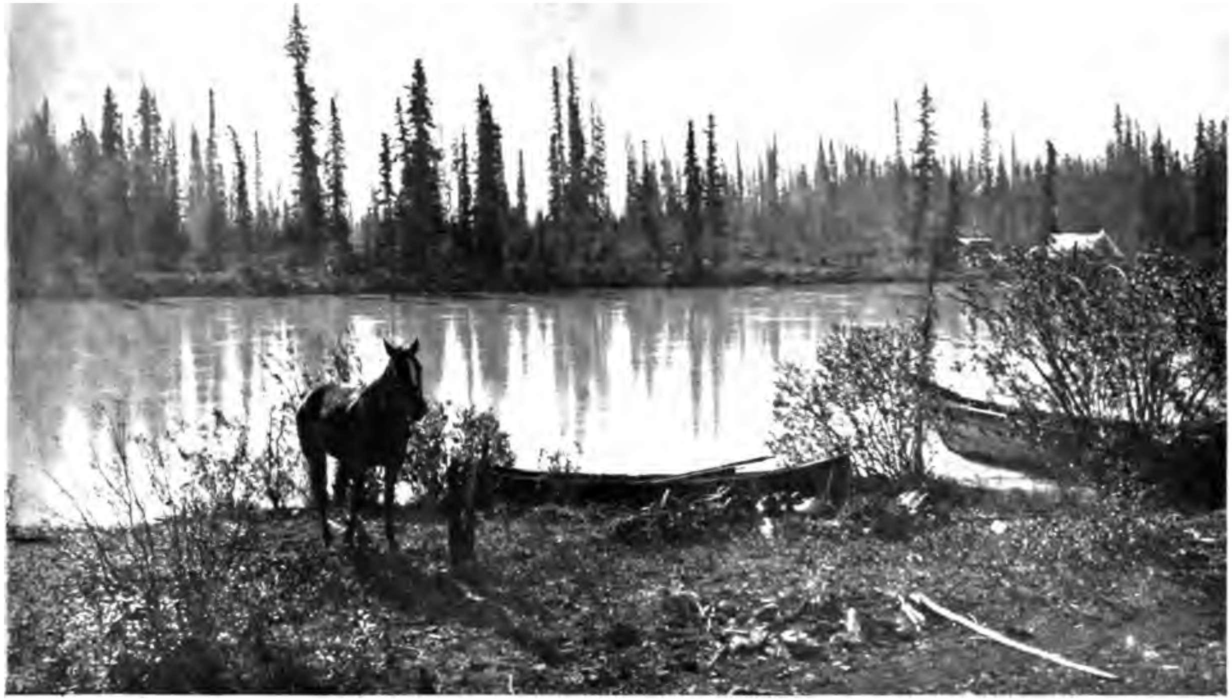
154.—ONE OF THE SMALL LAKES CHARACTERISTIC OF THE COPPER RIVER VALLEY.

155.—MOUNT DRUM AT SUNRISE.

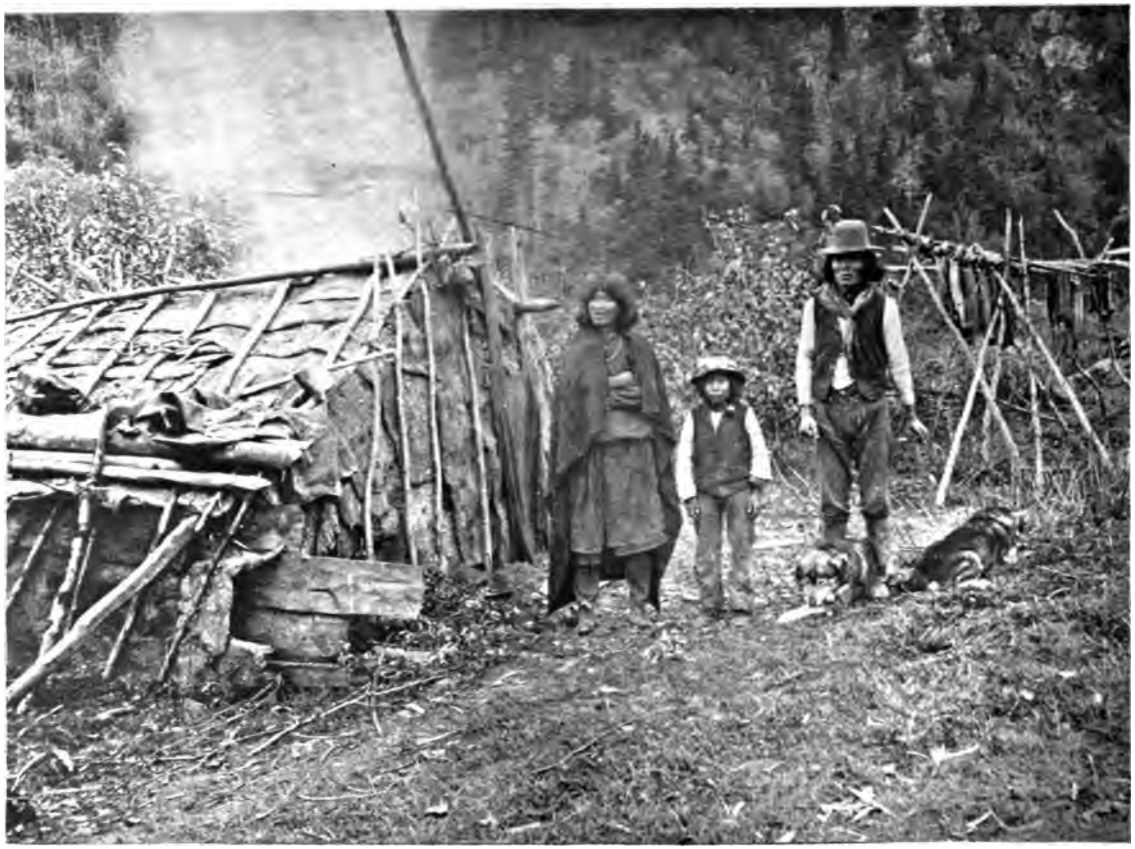
156.—COPPER RIVER VALLEY, FROM THE FOOT OF MOUNT SANFORD, LOOKING NORTH.



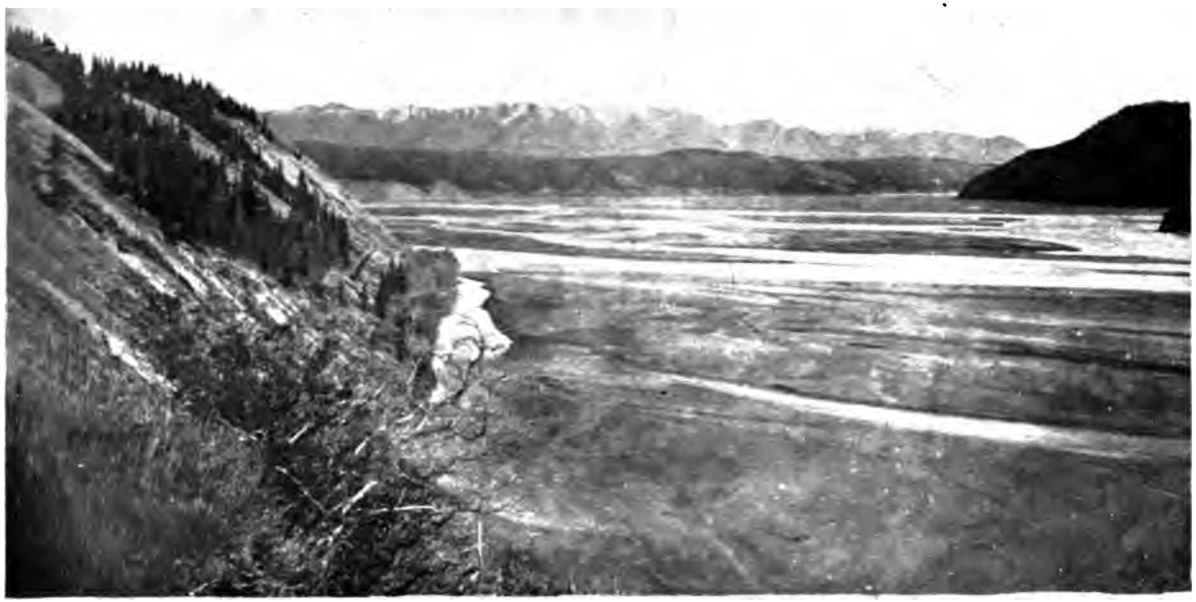
156.—COPPER RIVER VALLEY, FROM THE FOOT OF MOUNT SANFORD, LOOKING NORTH.



157.—KLUTENA RIVER, NEAR THE OUTLET OF LAKE ABERCROMBIE.

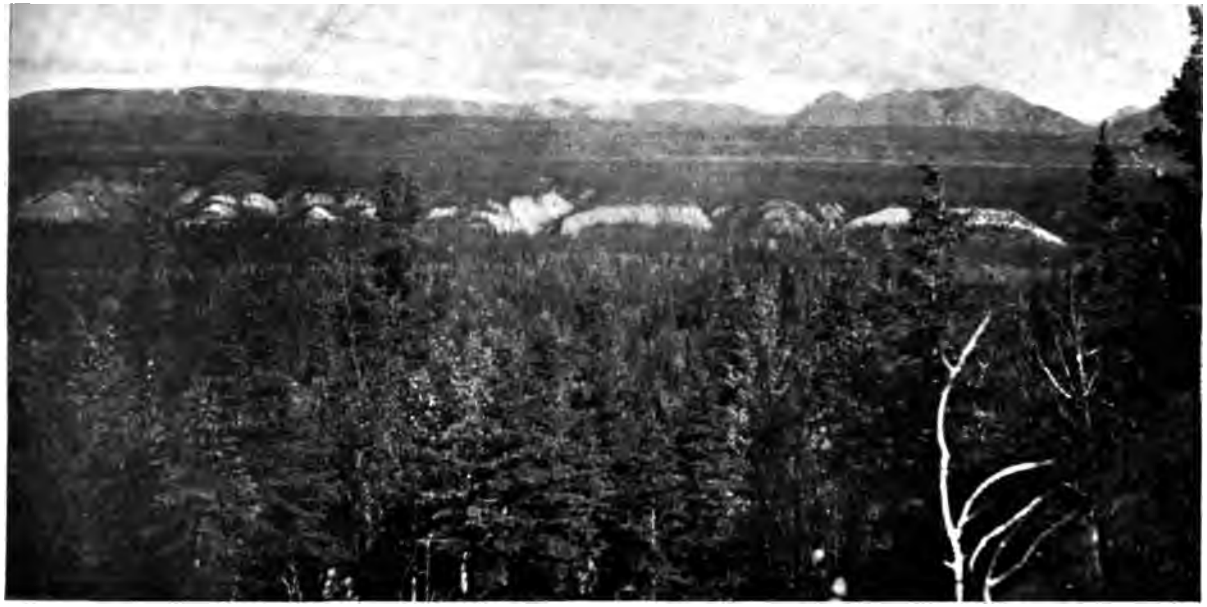


158.—ON COPPER RIVER, 1 MILE ABOVE TARAL; STICKWAN NATIVES.

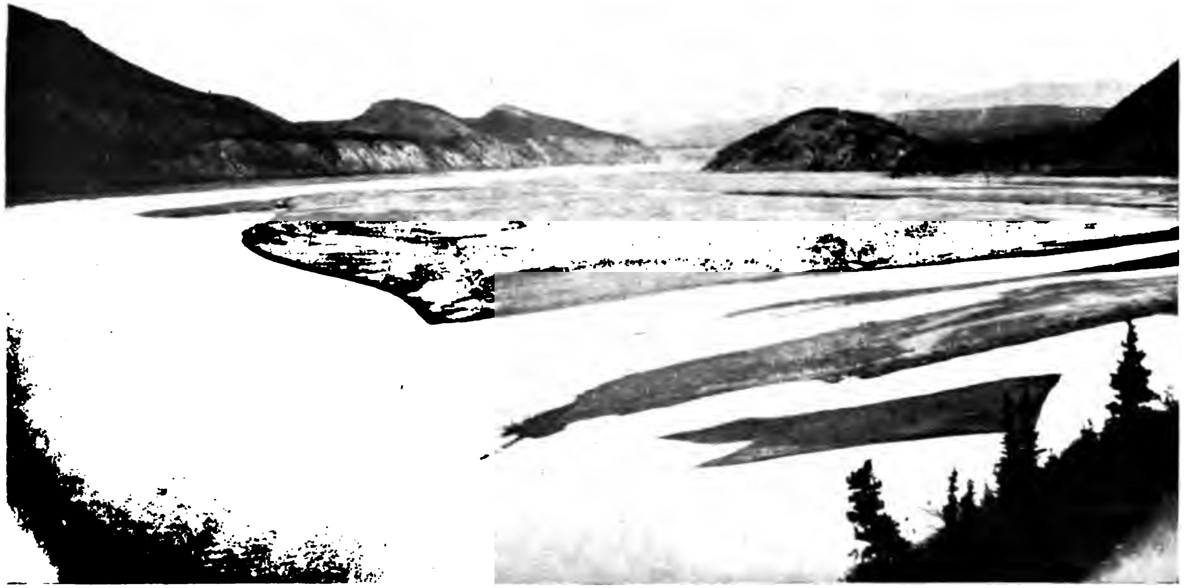


159.—COPPER RIVER OPPOSITE MOUTH OF CHITTYNA, LOOKING NORTHEAST.

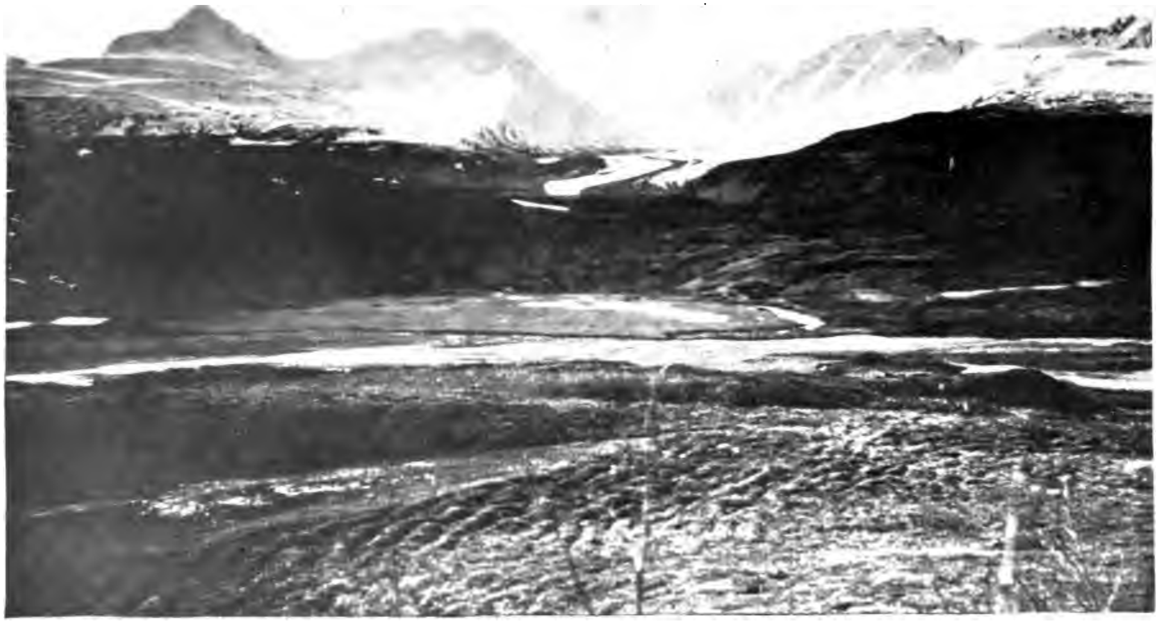
Chittyna comes in on right. Snow covered mountain to right of crater is Mount Blackburn.



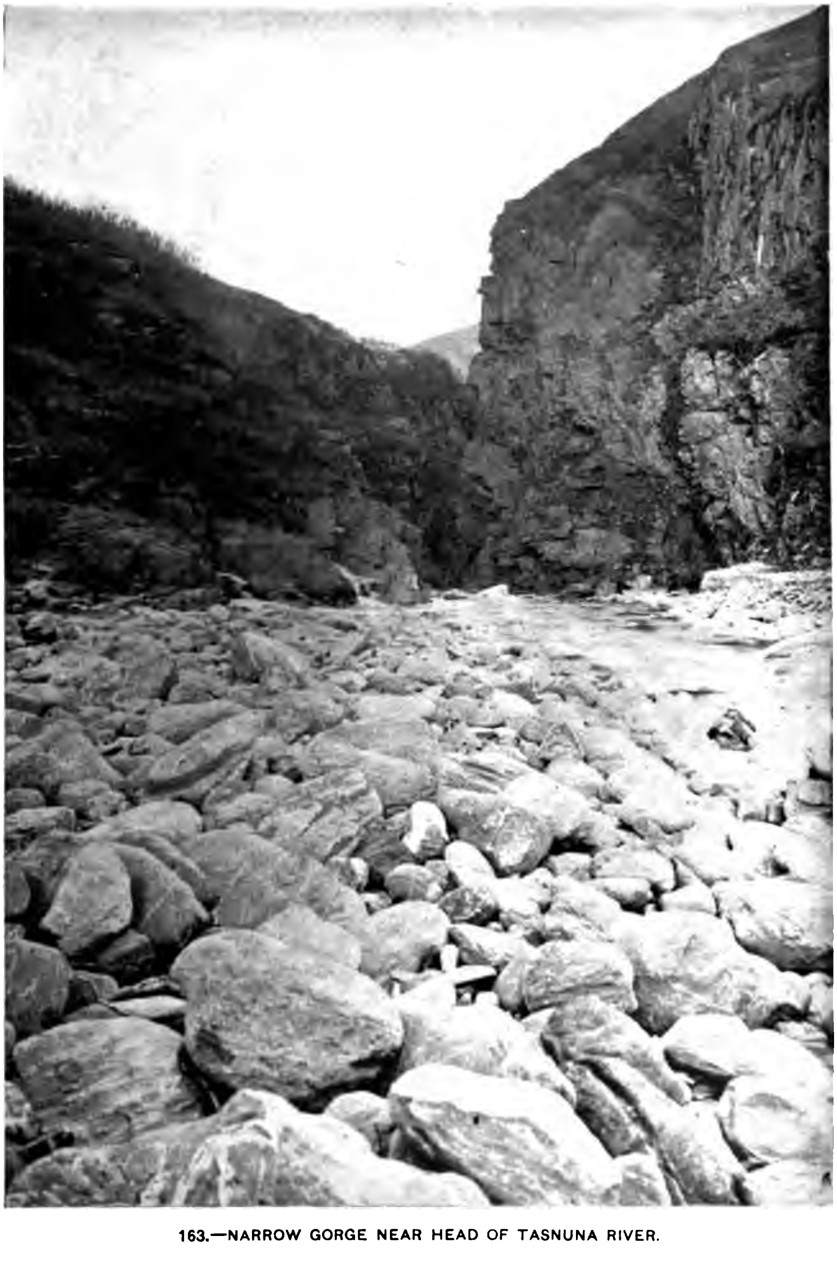
160.—ON COPPER RIVER; MOUNT TILLMAN AND COPPER RIVER BLUFFS.



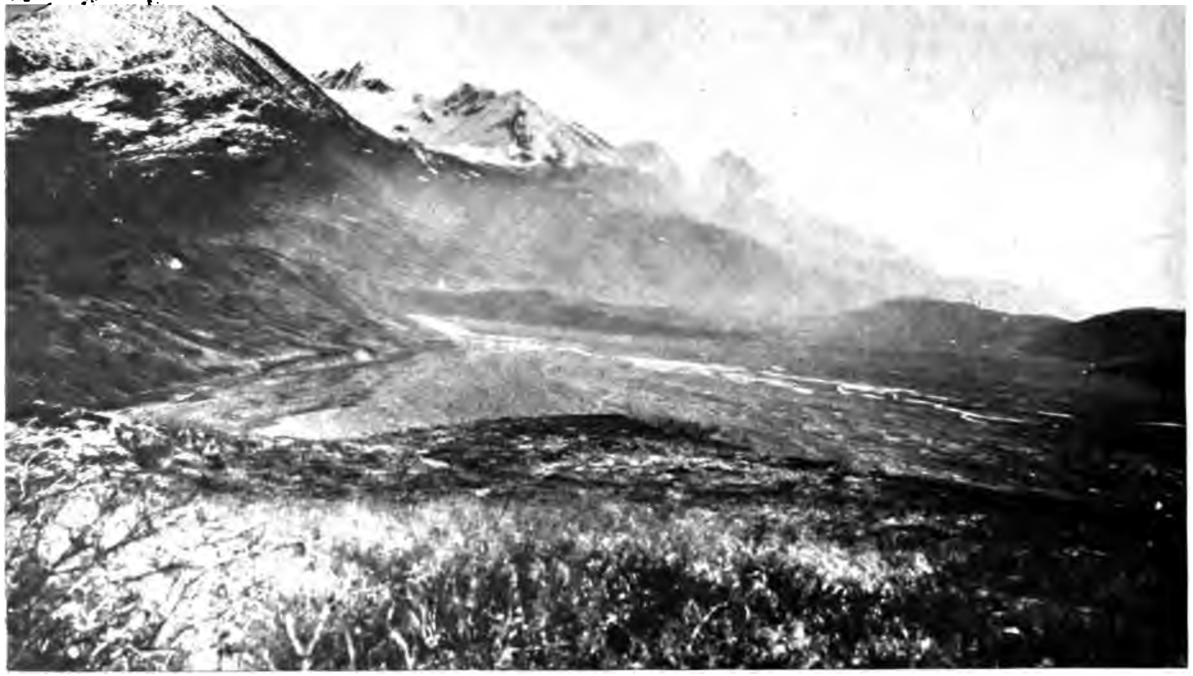
161.—LOOKING NORTH UP THE COPPER FROM MOUTH OF CHITTYNA RIVER.



162.—LOOKING UP THE SOUTH FORK OF LOWE RIVER FROM NORTH SIDE OF DUTCH FLAT.

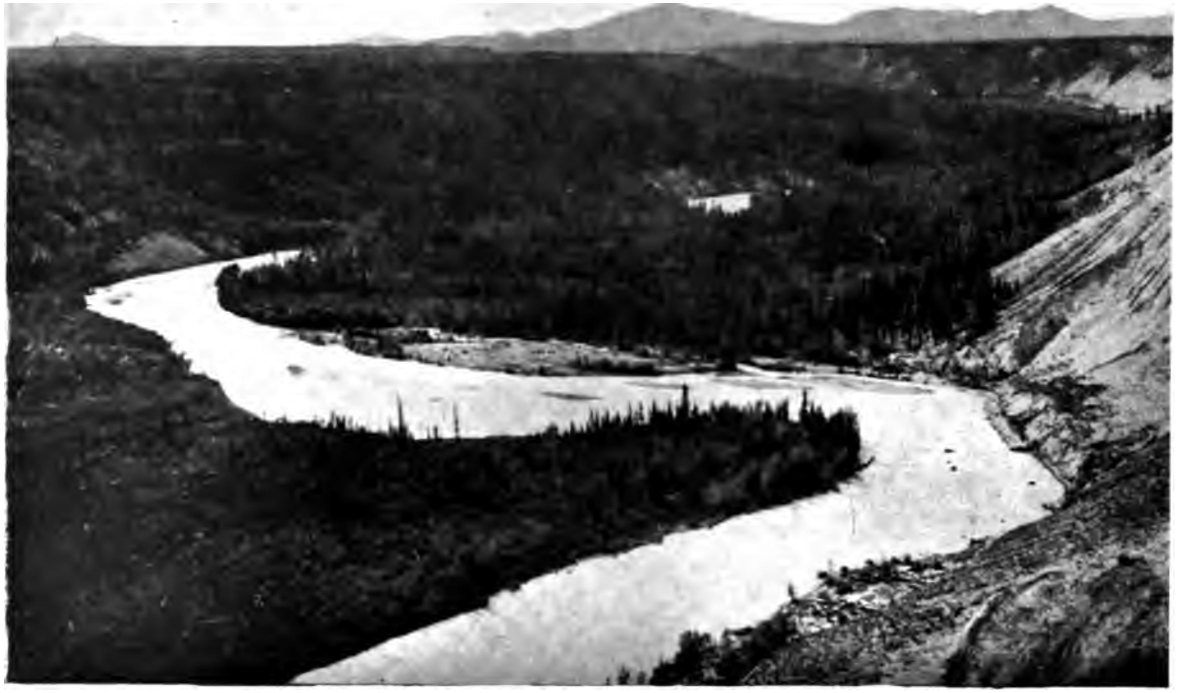


163.—NARROW GORGE NEAR HEAD OF TASNUNA RIVER.

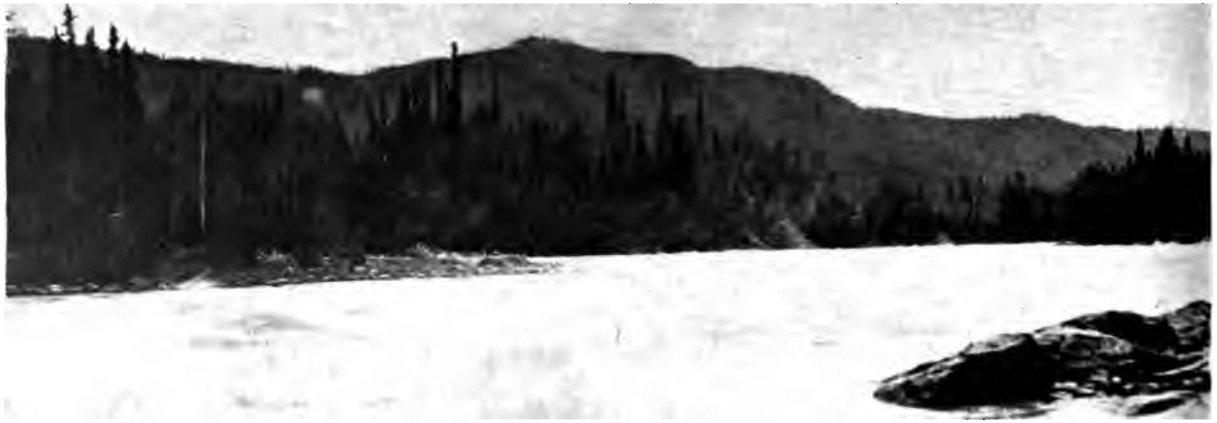


164.—MARSHALL PASS BETWEEN LOWE AND TASNUNA RIVERS.

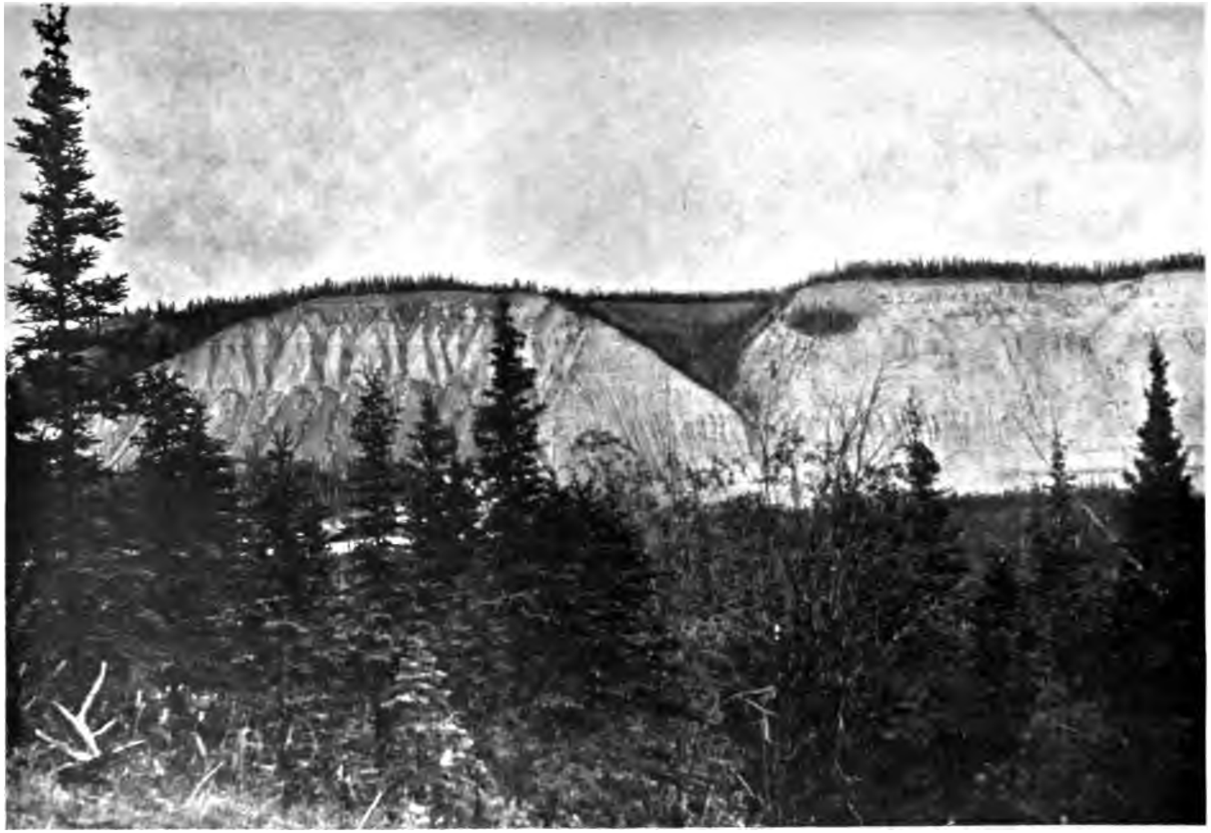
Lowe River head stream comes from canyon just to left of center.



165.—KLUTENA VALLEY, LOOKING SOUTHWEST. DEVILS ELBOW IN RIGHT CENTER.



166. AMEE RAPIDS ON KLUTENA RIVER, FROM WEST BANK.



167.- GRAVEL BLUFFS OF LOWER KLUTENA RIVER.

168.—LOOKING NORTHEAST ACROSS THE COPPER. MOUNT DRUM IN CENTER.